CULTURE AND COGNITIVE DEVELOPMENT* | 7

LABORATORY OF COMPARATIVE HUMAN COGNITION

CHAPTER CONTENTS

In attempting to understand the relationship between culture and cognition, we have found it useful to examine the historical antecedents of our current assumptions about mind, society, and the means by which we can understand their interrelations. Current debates within developmental and cognitive psychology recapitulate, to a startling degree, debates that occurred within the social sciences a century ago. It is our belief that a reexamination of the nineteenth-century theories of the relationship between mind and society in light of contemporary psychological research yields important suggestions for solutions to *current psychological debates* and provides a useful starting point for our essay.

NINETEENTH-CENTURY ANTHROPOLOGY: FOUR KEY ASSUMPTIONS

Four key assumptions underlie nineteenth-century anthropological assumptions about culture and cognition.

Cognition and Culture Are Aspects of the Same Phenomenon

Nowhere is this idea more clearly stated than by E. B. Tylor (1832–1917). His classic work, *Primitive Culture* (1874), begins with the assertion that "the condition of culture among various societies of mankind, in so far as it is capable of being investigated on general principles, is a subject apt for the study of laws of human thought and action" (p. 1).

Herbert Spencer (1820–1903), another major thinker of the late nineteenth century, shared Tylor's belief in the fusion of mental and cultural phenomena. He also drew an analogy between cultural development on the one hand and mental development on the other.

> During early stages of human progress, the circumstances under which wandering families and small aggregations of families live, furnish experiences comparatively limited in their numbers and kinds; and consequently there can be no con-

siderable exercise of faculties which take cognizance of the *general truths* displayed throughout many special truths. (Spencer, 1886, p. 521)

Spencer invites us to consider the most extreme case; suppose that only one experience was repeated over and over again so that this single event comprised all of a person's experiences. In this case, as Spencer put it, "the power of representation is limited to reproduction of this experience" in the mind. There is nothing else to think *about*. Next, we can imagine that life consists of two experiences, thus allowing at least elementary comparison. Three experiences add to the number of elementary comparisons and the elementary generalizations that we make on the basis of our total experience. We can keep adding experiences to our hypothetical culture until we arrive at the rich variety that characterizes our lives. It follows from this line of reasoning that generalizations (the "general truths" attainable by people) will be more numerous and more powerful the greater one's experience. Society provides experience, and some societies, so it was believed, provide a greater diversity of experience than others, cementing a neat bond between cultural progress and mental progress.

Culture Is Characterized by Levels of Development

This idea, and the associated idea of progress, are also epitomized by Tylor:

> We may fancy ourselves looking on Civilization, as in personal figure she traverses the world; we see her lingering or resting by the way, and often deviating into paths that bring her toiling back to where she had passed by long ago; but, direct or devious, her path lies forward, and if now and then she tries a few backward steps, her walk soon falls into a helpless stumbling. It is not according to her nature, her feet were not made to plant uncertain steps behind her, for both in her forward view and in her onward gain she is of truly human type. (Tylor, 1958, p. 69)

This hyperbolic summary nicely illustrates the intertwining of social and individual aspects of society in Tylor's thinking.

Levels of Culture (or Degrees of Civilization) Are Uniform Within Societies

Tylor's main criteria for judging the stage of a culture were the sophistication of its industrial arts, including the manufacturing techniques for metal tools and agricultural practices, and "the extent of scientific knowledge, the definitions of moral principles, the conditions of religious belief and ceremony, the degree of social and political organization" (1874, p. 27). From this point of view, a stage of culture could be indexed by any of these criteria, since each is characteristic of the society's stage or level.[1]

Change Is the Result of Endogenous Mental/Social Factors

This assumption is embodied in two central concepts of nineteenth-century evolutionary theory. First, there is the doctrine of psychic unity, the idea that the basic principles of mind are the same in all human groups. Second, there is the principle of independent invention, the idea that cultural change arises from the universal human mind operating on problems universal to a given stage of cultural evolution.

These ideas were attractive because, if true, they would enable anthropologists to fulfill their central task—to establish universal laws of human history by reconstructing the series of steps by which all societies have attained their current rank and the factors that have produced differential movement toward human perfection.

The Boasian Critique

When combined with Darwin's theory of the evolution of species, the grand historical scheme laid out by the fathers of anthropology had a satisfying inevitability to it. As Tylor remarked, it seemed to put the facts in order.

Into this orderly theoretical world stepped Franz Boas (1858–1942), a German scholar whose training brought together several of the major intellectual trends of the nineteenth century. Trained initially in the physical sciences, Boas spent a period in Wundt's laboratory, where research was aimed at constructing a technique to access directly elementary sensations. Wundt's building blocks of mind.

The basic strategy of Wundt's experiments was to get at the very earliest stages of what we would

now call information processing. The goal of psychology was to focus on the "raw," "initial" response evoked by very well-specified physical stimuli. It was crucial that the subject not allow any interpretation to intervene between stimulus and response, which was duly recorded in very precise terms—usually reaction time. E. G. Titchener, Wundt's most influential heir in America, went beyond Wundt's plan to insist that the verbal report of sensations, obtained by introspection, had the same precision and reliability as the reaction-time measures.

Significantly, Titchener and other structuralist psychologists believed that if special care was not taken to shear away the subject's elaborated interpretations, raw sensation would be hopelessly mixed with conceptual information (ideas) of an uncontrolled sort, precluding any possibility of discovering the laws by which elementary sensations combine to form ideas. Today, we are familiar with the failure of the structural enterprise in terms of arguments over the irreducibility of thought to elementary sensations, irreconcilable differences arising from conflicting introspective reports, and of American disenchantment with a psychology that precluded the study of practical problems.

Boas questioned the adequacy of such notions on different grounds. It was his belief that the structuralists were mistaken about the purity of the verbal introspective reports they obtained. That is, information other than that narrowly activated by the physical stimulus was affecting the subjects' verbal reports. But because subjects were carefully trained to report as if this were not true, and because procedures were standardized so as to minimize the influence of external information, it *appeared* as if pure sensations were being described. Boas asserted that even "elementary" sensations were conditioned by their contexts of occurrence. His first fieldwork among the Eskimos sought to obtain evidence for this position. Over the course of several decades of research and writing, Boas reconstructed our concept of culture and in the process brought into question the basic assumptions that had guided anthropological research up to this time. (For an outstanding interpretative account, see Stocking, 1968.)

Significantly, Boas was one of the first major figures in anthropology to do fieldwork in societies very different from those of Europe. The theoretical and empirical anthropological work prior to Boas was built largely on the reports of travelers, missionaries, and colonial officers. When he first began his fieldwork, Boas was prepared to find the evolutionary cultural sequence required by the theories of

Spencer and Tylor. However, he was unhappy about the evidence that had been used previously to substantiate such sequences. It was important to evolutionary theorists that "independent inventions" be the dominant form of cultural change to enable historical reconstruction. The diffusion of ideas between groups linked by history and geography was acknowledged, but diffusion was an unwanted source of "noise" in the cultural system, for it obscured the true developmental history. Where two or more groups of people lived in a single locale and shared a common ecology and similar histories, one would expect, of course, to find similar developmental histories at similar rates. But diffusion as a major contributor to culture was downplayed in the ethnological literature.[2]

The assumption of cultural uniformity, which was the basis for ranking cultures in terms of historical development, was equally important to evaluate. Boas's experience among the peoples of the American and Canadian Northwest revealed a pattern of language, custom, and myth that shattered his initial expectations. Instead of uniformity of cultural features, he found diversity that defied either a simple diffusionist or an independent-invention explanation; tribes with the same basic languages were found to adhere to very different myths and beliefs, and tribes with very different languages were found to have almost identical myths and beliefs. Nor was it possible to assign cultural levels to individual features of a culture on the assumption that the course of their development and their current form could be deduced from a common set of rules acting over time. His work on Kwakiutl art emphasized the abstract intellectual work involved in the representation of natural forms. His work on social organization revealed a complexity that badly damaged evolutionary theories of kinship and marriage forms. For example, kinship regulations among the Kwakiutl appeared to result from a mixture of "maternal laws" in a group that was expected to be at a "paternal" stage according to accepted criteria of anthropology at the time. This observation directly contradicted the traditional evolutionary sequence from maternal to paternal forms of kinship regulation.

Moreover, the assumption that different cultural elements will cohere in a uniform manner proved to be incorrect; for, even if a particular cultural product can be said to have been produced by the same historical-cultural process in two cultures, it is unsafe to assume that the same laws apply to other domains within those cultures. Each aspect of culture has to be examined in its own right and its relations to other

aspects within the same society examined to discover the pattern of adaptation that organizes the parts; uniform complexity as a principle of cultural organization does not describe cultural realities. In short, culture features do not cohere with respect to any known rules that seem to apply to all cultures in all places. Boas was forced to conclude that each culture represents a combination of locally developed and borrowed features, the configuration of which is an adaptation to the special constraints operating on the people in question.

The contrast between Boas and the evolutionary anthropologist is especially relevant to developmental psychological issues, which were a part of their debate. The notion that "primitives think like children," for example, was much discussed by nineteenth-century anthropologists and psychologists (see Chamberlain, 1901; Gould, 1976). The conclusion is inescapable given the Tylorian premises that mind and society are aspects of the same set of processes, that society is characterized by uniform states of development which allow comparison across societies with respect to level, and that children are less developed forms of adults.

However, if societies are characterized by heterogenous constituent elements, and if all societies can be considered equally valid responses to the historically accumulated problems of survival, there is no basis for comparison across societies with respect to general levels of development. Certainly, it is illegitimate to take particular activities out of context as the basis for comparison unless it has been demonstrated that these activities play an equivalent role in the life of the people being compared.

For Boas, not all life's experiences are sewn from the same cloth; they are alternatively simple or complex, depending on the demands made by the total configurations of one's cultural environment. So, too, with mental achievements. If we want to understand thought processes being manifested in any particular context, we need to know the way that this context fits into the current life experiences of the individuals being studied as well as into the past history between and within cultures that have shaped the context in which we make our observations.

Summary

Despite their obvious brevity and the oversimplification that such brevity entails, the foregoing remarks on the modern history of the problem of culture and cognition frame the major issues that have continued to occupy social scientists through-

out the twentieth century. We can abstract the following issues from the discussion:

1. It is possible to specify certain adaptive problems faced by all people everywhere because of their common membership in the species, *Homo sapiens*. Their (phylogenetically) common history of problem-solving experiences has resulted in the evolution of a common repertoire of responses to universal aspects of the ecology that are satisfactory in terms of propagation of the species.

2. Many scholars see a single principle of directionality in social history as well as individual biography. The concepts of evolution and development in both anthropology and psychology grow out of a common concern for understanding the origins of humankind as a means to understanding human nature.

3. Despite the overall communality of the life predicaments of *Homo sapiens*, there is variability in the organization of response to these predicaments, depending on the specifics of the "individual" case. The unit that serves as the individual is sometimes the individual person and sometimes the individual culture. There is a very strong tendency among the scholars whose work we have reviewed to draw an analogy between "individuals" at the cultural and personal levels of analysis.[3]

4. It is widely held that the structure and content of early experience shapes the nature of later experience. When Wordsworth asserted that "The child is father to the man," he was speaking for anthropology and psychology as well as for local folk knowledge. Insofar as it is true, this assertion commits the scholar to historical (genetic) analysis in an effort to understand the constraints that shape the current configuration of the system.

5. A major disagreement centers on the problem of uniformity and diversity within whatever unit of analysis the scholar chooses. At the cultural level, the problem of uniformity is central to discussions of cultural evolution. At the individual level, the problem of uniformity is central to discussions of stages of individual development. The issue of uniformity is central to any theory linking individual behavior to cultural experience, and it is central to all theories of change.

In the discussion that follows these issues will appear and reappear in different guises. For example, one prevalent position asserts that there are no important cultural variations in cognition; at most, one can expect to find superficial differences in cog-

nitive content. *Homo sapiens* common phylogenetic history of "problem solving" has produced a common response of the species to its predicaments. We will present Piaget's genetic epistemology as the major example of this position.

Rejection or modification of this universalistic thesis takes several forms. One line of reasoning builds directly from the logic of a universal set of problems by asserting that the specifics of human problem-solving environments are organized by the particulars of their ecology and historically conditioned responses to it. A group's common experience with a local set of unusual constraints will produce between-culture variation, but *within-culture universals*. According to this view, Eskimos and Bushmen share many common problems, but the configurations of adaptation to the specifics of their predicament will produce nontrivial differences in adaptation and, therefore, nontrivial differences in thought. From this perspective, all existing cultures are equally valid responses to unique configurations of historical experience. The "cognitive styles" they produce are said to be correspondingly adaptive. This approach will be reviewed in terms of Berry and Witkin's work.

A second line of reasoning which challenges the tenets of the universalistic thesis and is herein called a context-specific framework, treats culture and cognition as aspects of a single interacting system of coordination between individuals and the socially conditioned contexts of their everyday lives. In effect, the context-specific approach in studies of culture and cognitive development extends Boas's insights concerning the heterogeneity of activity across settings within cultures into psychology. Instead of the universal laws of mind that control development "from above," the context-specific approach seeks to understand how cognitive achievements, which are initially context specific, come to exert more general control over people's behavior as they grow older. The context-specific approach to culture and cognitive development takes "development within domains of activity" as its starting point; it looks for processes operating in the interactions between people within a particular setting as the proximal cause of increasingly general cognitive competence.

For all theories, the rules governing connections between aspects of cultural experience and aspects of mind are a central concern. The solutions proposed by alternative approaches to the question of mind and culture are related insofar as they account adequately for both uniformity and diversity of cultural/mental phenomena.

COGNITIVE UNIVERSALS: PIAGET

Piagetian-inspired cross-cultural research has been the subject of extensive discussion and review (e.g., Dasen, 1972, 1977; Dasen & Heron, 1981; Glick, 1975; Greenfield, 1976; Jahoda, 1980; Laboratory of Comparative Human Cognition, 1979; Price-Williams, 1981). Consequently, our discussion will be highly selective, focusing on central areas of accomplishment and uncertainty.

The cognitive processes that Piaget's theory is intended to explain are the acquisitions of very general schemes that are related to each other in a logical, hierarchically organized sequence.

The basic assumption underlying the bulk of Piaget's work prior to the 1960s was that the basic cognitive achievements observed in Genevan children are universal (for a brief, but comprehensive review, see Piaget, 1970). The basis for this assumption was Piaget's belief that the possible basic forms of interaction between the growing child and his or her environment are defining characteristics of *Homo sapiens*.

However, from very early in his career, Piaget manifested a keen interest in the work of the French sociological school, and particularly the speculation about cultural differences in thought proposed by Lucien Lévy-Bruhl (Piaget, 1955, p. 21). But early remarks about the minds of primitives and children have amounted to no more than speculation on Piaget's part. Almost no appropriate data were at hand to provide concrete tests of such ideas.

Four Factors Contributing to Development

Responding to the growing number of researchers exporting his tasks to non-Western cultures, Piaget (1966, 1974) attempted to clarify the possible contributions of cross-cultural research to his theory. He did so in terms of four theoretically distinct factors that would be expected to contribute to the process of development.

Biological Factor

Piaget draws heavily on biology and particularly biological evolution for his explanation of ontogenetic development (Piaget, 1963). But, as indicated in the passage above, he is careful to distinguish the process of cognitive development from the maturational process of physical development. If the biological factor dominates cognitive development, Piaget would expect little or no effect of the cultural environment on either the developmental sequence that unfolds or on the rate at which the unfolding occurs.

Equilibration Factor

This factor is at the heart of Piaget's theory of development (Piaget, 1970, 1977). What the child comes to know about the logic of its world is not based solely on relations that are preexisting in the environment nor on the teachings of its caretakers; rather the child must act on and interact with its environment. What the child comes to know is the form of this interaction. Piaget does not deny that children are taught much of what they know or that explicit teaching is not dominated by the equilibration factor. But he does claim that the acquisition of fundamental logical knowledge structures is dominated by this process of equilibration.

The process of equilibration is best considered to be both universal *and* sensitive to the environments created by specific cultures. Cultures may differ in the extent to which their particular practices provide opportunities for experiences or "operational exercises" of the required kind. To the extent that such variations exist, Piaget should predict that different cultures will retard or accelerate the equilibration process but that the sequence of knowledge structures will be universal.

It has proven difficult to interpret Piaget's notion of equilibration in terms of cultural variations in experience. Dasen (1972) and others interpreted equilibration vaguely as "factors, which arise as the young organism interacts with its physical environment" (Laboratory of Comparative Human Cognition, 1978, p. 148). A more thorough examination of Piaget's writing indicates that this interpretation is too narrow, although it describes the vast majority of Piagetian research.

Social Factor of Interpersonal Coordination

Piaget distinguishes between the effect of the teachings of a particular culture (Factor 4) and the effects on development of the features that all societies have in common. In all cultures, there is a socialization process involving social exchanges among children and between children and adults.

Both theoretically and practically, this social factor enters into exceedingly complex relations with Factors 2 and 4. To understand the difficulty of distinguishing social factors from equilibration, we must consider more carefully Piaget's conception of the relationship between the individual and society.

Piaget (1968) describes children engaged in an

activity where they are free to work together or alone:

> Among the younger children, there is no distinct dividing line between individual activity and collaboration. The young children talk, but one does not know whether they listen. Several of them may be at work on the same project, but one does not know if they are really helping one another. Among the older children, there is progress in two directions: individual concentration when the subject is working by himself and effective collaboration in the group. (p. 39)

In contrasting younger and older children in this passage, Piaget shows that he considers "egocentricity" or the lack of it to be a feature of both the children's intellectual structures and the social organization of the work group. The same process of equilibration operates both to coordinate the schemata of the individual and to coordinate collective action. This process operates whether the collective actions include those among peers or between children and cooperative (rather than coercive) adults. If we ask whether the intellectual operations are the cause or effect of cooperation, Piaget answers that it is like the question of "whether the chicken appears before the egg."

> Logic constitutes the system of relationships which permit the coordination of points of view corresponding to different individuals, as well as those which correspond to the successive percepts or intuitions of the same individual. (1968, p. 41)

A new structure of knowledge (logic) cannot arise simply from the internalization of cooperative action, since internal coordination is necessary for cooperation to take place. And it must take place to be available in the child's environment to be internalized.

Then how can "interpersonal coordination" be considered a factor having an independent effect? The distinction can be made, if at all, by shifting our focus from a structural description of the equilibrium of internal and external structures and by considering instead the process by which an individual may achieve that coordination. Piaget (1973) has suggested, and current Genevan research (Doise, Mugny, & Perret-Clermont, 1975) is exploring, the hypothesis of a unique role for the fact that "in any environment individuals ask questions, exchange information, work together, argue, object, etc."

(Piaget, 1974, p. 302). Essentially, the idea is that two children working together may each notice different aspects of the same situation and need to coordinate these perceptions, whereas a child working alone would notice only one aspect which would not need to be coordinated.

While the general structure of interpersonal coordination is independent of content and universal, cultures may vary in the number or nature of opportunities they provide for such interpersonal experiences.

Factor of Educational and Cultural Transmission

The final factor in Piaget's list includes all the specific features that make the social environment of one culture different from that of another. The child learns specific skills and beliefs, both through formal and informal education. This is not to say that learning particular cultural practices does not also include a certain amount of more general experience. In fact, a particular craft—pottery, for example—may provide more operational exercises of some kinds than other practices, such as mapmaking. If some societies provide more overall experience relevant to discovering the nature of the environment, true developmental differences would exist between those cultures in either the rate or final level of development.

It should also be clear from the previous discussion that the final three factors all operate singly and in common to increase the level of a child's thinking through a series of substages and stages. More operational exercise is possible in all three realms; a little more operational exercise leads to a little more development. The problem then is to identify dimensions of cultural difference that are theoretically significant in order to predict the course of cognitive development in different cultures.

Overall Stages

Piaget describes four major stages of development, which form an invariant sequence. Many tests of Piaget's developmental theory are formulated cross-culturally as attempts to confirm the presence of one or more of these four stages. Typically, several age groups are sampled, and the age at which given percentages of the various groups "pass" the test are compared to each other and to the studies conducted in Geneva (or in other cultures of interest). "Passing" may consist not only of giving an answer to the problem that is associated with the stage in question but also of giving an appropriate

justification for the answer given. Correct performance on these tasks is used as an index of the presence of the mental operations that are assumed to be necessary for that task.

Obviously, researchers working in the field cannot try out all the tasks that have been used to create modern Piagetian theory. For the most part, the cross-cultural research has focused on the concrete operational stage that, among the Swiss children studied by Piaget and his colleagues, begins at about 7 years. It is supplanted by research on the formal operational stage which begins at around 12 years.

Sensorimotor Intelligence

Piaget has consistently maintained that, in order to understand knowledge, one has to be able to chart its development. In 1936, Piaget published his detailed observations and formulations of the first stage of intellectual development. Sensorimotor intelligence begins at birth and ends with the beginning of symbolic thought during the second year.

Only recently have researchers shown an interest in this early period, and, as yet, there have been very few cross-cultural studies (Dasen, Inhelder, Lavallee, & Reschitzki, 1978; Goldberg, 1972; Kopp, Khokha, & Sigman, 1977). The formulation of a number of ordinal scales of sensorimotor intelligence (Casati & Lezine, 1968; Corman & Escalona, 1969; Uzgiris & Hunt, 1975) has provided cross-cultural researchers with standardized norms that can now be used to investigate the behavior of infants in non-Western cultures. On other measures of infant development, particularly motor skills, African infants have performed at higher levels than Western infants. This precocity makes African infants an interesting population for comparisons of sensorimotor intelligence.

Dasen (1977) reports the results of two recent research studies: one cross-sectional, conducted by Bovet and Othenin-Girard in 1975; and the other longitudinal, conducted by Dasen, Inhelder, Lavallee, and Retschitzki in 1973–1975. In these studies, the performance of Baoulé children from the Ivory Coast was compared to norms established by French children on the Casati-Lezine Scale of Sensori-Motor Intelligence (1968). This scale consists of seven task-series, each composed of hierarchically ordered subtasks. In both studies, no evidence was found for a generalized claim of mental precocity of African infants. Instead, they found that there was a consistent and obvious advancement throughout the age range for African infants on the task-series that involved combinations of objects and the use of objects as instruments. On other task-

series, involving object permanence and object explorations, their behavior more closely paralleled that of the French sample and even showed some slight advances, except in two subtasks, in which there were slight delays.

To understand the reasons for both the advances and the delays, Dasen points to the need to examine the cultural context in which the tasks occur. The few items on which African infants show a delay can be explained in terms of the content of the problem:

> They [the tasks] require the manipulation of some bizarre apparatus, such as rotating a wooden board, or opening a matchbox. It is probably not the lack of familiarity with the test material as such that causes the difficulty; the plastic tube and rake, and toy cars and other objects, used for further tasks, are quite unfamiliar to the infants in the study, and despite this, they manage to use them satisfactorily. Rather, it seems to be the type of manipulation, the rotating around an axle, or sliding the inner part of the box, which is not culturally relevant. Few objects exist in the child's environment that would require such actions. Whereas the European child would usually have plenty of occasions to observe or manipulate toys, furniture, or other objects which involve a rotation or sliding movements. (Dasen, 1977, p. 162)

The differential rates of sensorimotor development are clearly influenced by cultural characteristics, particularly by the predominant mode or quantity of stimulation and by the cultural value placed on particular skills.

Even though there were clear differences in the rate of sensorimotor development between these two groups, Dasen emphasizes the similarity of the overall developmental pattern. The way actions become ordered and integrated into action patterns across cultural groups is highly similar, even when the materials used are unfamiliar to the child. Dasen suggests that the similarities in developmental pattern between very different cultural groups leave open the possibility that there may be generalities in the way infants interact with their environment, constructing knowledge that becomes the basis of later cognitive processes.

Concrete Operations

Attainment of concrete operations is the aspect of Piaget's developmental theory that is most frequently studied cross-culturally. There are perhaps two reasons why this is so. The first involves the

nature of the tasks. Concrete operational tasks require the manipulation of physical materials that can be easily transported to exotic cultures or constructed on the spot. A second reason has to do with the activities that constitute the tasks: they can be scored "right" or "wrong." Western psychologists who work in a tradition of quantitative assessment of psychological processes find it easy to standardize the application. Although, in fact, the "clinical" aspect of the concrete operational tasks is fundamental to interpreting responses, the complex interaction required by Piaget tends to drop out of many cross-cultural analyses (cf. Kamara, 1971; Nyiti, 1973).

Population samples from other cultures have been found to achieve concrete operations sooner, at the same time, or later than European and American samples. In some studies, a significant proportion of adults has failed to achieve concrete operations. A variety of explanations, which we will discuss presently, have been offered to account for these results.

Formal Operations

Piaget (1970) characterizes the thinking process of young children as "concrete" operational because it relies on the actual manipulation of objects and events in the immediately present context. Formal operations are not tied to reality in the same way. They enable the adolescent to reason in terms of verbally stated hypotheses.

A second difference between concrete operations and formal operations results from the development of a new organization of cognitive structures. While the concrete operational child reasons from one element to the next, with no overall structure for representing relationships, formal operational adolescents are able to consider systematically the complete set of possibilities.

Genevan adolescents were found to reach the 75% success criterion for each of the substages between 11 and 15 years of age. That is a rare, high level of success.

Although Inhelder and Piaget (1958) used 15 different formal tasks, attempts to assess the presence or absence of formal operations typically use a single task and draw inferences about the whole mental organization of the mind, based on this single task. Neimark's (1975) review of these studies reports a consensus that the level of performance is lower in other cultures than the level reported for comparable ages in Geneva. The older cross-cultural research generally failed to find evidence of formal operational thought among nonschooled, non-Western populations. Recently, there has been some evidence for the existence of formal operational thought

in non-Western, schooled populations. Za'rour and Khuri (1977) found evidence of a shift from concrete performance to formal operational performance on time/distance problems in Jordanian children at about 13 years of age. Saxe (1979) also documented the presence of formal operations in a population of schooled children from Papua, New Guinea. His work represents a break from other studies of formal operations in exotic cultures because he utilized an *indigenous* knowledge system, the birth-order system. Saxe explored the development of the ability to coordinate two reference systems and to generate the possible or hypothetical combinations of birth orders in a family (combinatory logic). He finds evidence of a shift from concrete to formal understandings between the ages of 13 and 19.

Jahoda (1980) presents an especially helpful discussion of the implications of the formal operations cross-cultural research. Citing evidence from the informal reports of explorers and the more formal reports of anthropologists, Jahoda illustrates behaviors that apparently require formal operational thinking among people who have not manifested formal operational thinking in experimental settings. Jahoda's central conclusion is that Piaget's reliance on actions in the physical world is a "bias that may be unjustified, resulting in a misclassification of subjects in traditional societies whose logic gets the main chance to manifest itself in verbal behavior in the social domain" (Jahoda, 1980, p. 119).

Jahoda's suggestion as well as the possibility of domain-specific stage acquisition are two major directions that research on culture and cognitive development have been taking. These themes will recur frequently in the remaining discussion.

Within-Stage Variability

In addition to variability in the age at which children from different cultural groups attain one or another of the global Piagetian stages, there is variability to be accounted for in the manifestation of stage-appropriate behavior *within* stages. Within a Piagetian framework, this kind of variability has traditionally been referred to as *horizontal décalage*. Among Genevan children, for example, there is an ordering of the acquisition of conservation that begins with conservation of quantity, then weight, then volume.

Strictly speaking, studies of horizontal décalage are not motivated by Piaget's theory, since he does not predict within-stage sequences of concept acquisition. They have been of interest to Piagetians partially because they are not properly incorporated

into the theory and because obvious lines of accommodation of facts to theory suggest ways in which experience might influence development.

The cross-cultural evidence on the invariance of within-stage concept acquisitions is ambiguous. Early studies found the order of conservation of quantity, weight, and volume to be consistent with Piaget's description among Iranians (Mosheni, 1966), Sicilians (Peluffo, 1967), and Chinese (Goodnow, 1962). Dasen (1970, 1972), Boonsong (1968), and Prince (1968, 1969) found that conservation concepts developed at the same time as each other, while Bovet (1974) and Otaala (1971) found that the sequences of within-stage operational development differed in their samples. Dempsey (1971), using different cultural groups in the United States, found differing décalage among them on time-conservation tasks. Kelly (1977) found effects of schooling on décalage among conservation tasks with New Guinea children.[4]

Piagetian Treatments of Variability

After evaluating the mounting evidence of both the age variability in achieving various "universal" cognitive operations and the within-stage variability in achieving operations connected with the specific materials being manipulated, Piaget (1972) offered three global courses that might explain such performance variabilities.

First, "different speeds would be due to the quality and frequency of intellectual stimulation received from adults or obtained from the possibilities available to children in their environment" (Piaget, 1972, p. 7). Second, Piaget suggests the possibility that formal operations are not the expression of a universal stage, but a form of cognitive specialization (in the manner of an aptitude) that permits certain individuals to penetrate particular domains of experience more deeply than others. The third possibility, the one which Piaget favored, was to assume that all individuals reach a universal stage of formal operations but that formal operations are acquired first (and perhaps only) in fields of adult specialization or in connection with special aptitudes.

None of these possibilities was pursued by Piaget himself, and it is not entirely clear how "aptitude" as a theoretical entity should enter Piagetian theory. However, a number of investigators have been attempting to reconcile Piagetian theory with the evidence that differences in cultural experience underlie developmental delays in performance on Piagetian tasks. In some cases, the reconciliation seeks to explain away the performance differences as the result of experimental artifact; in others, the theory is modified to accommodate the data.

The most traditional approach to this set of problems is to claim that reported cultural differences in cognitive achievement are the result of methodological artifacts. That is, *real* cognitive development is universal; psychologists simply get a mistaken impression of their subjects' competence because of the specific assessment activities that they depend upon.

This conclusion was suggested by Kamara and Easley (1977) and Nyiti (1976). In their investigations these two research teams each used a native speaker as the experimenter who was also a psychologist trained in clinical interviewing. Their developmental curves approximate European norms. Unhappily for the theory, these studies did not manipulate the factors of language and cultural membership of the experimenter. There has been enough variability in previous between-study comparisons to make it unlikely that these factors alone are sufficient to account for many of the cultural differences that have been reported (e.g., in Dasen, 1977).

However, there is no doubt that features of the interactions involved in assessing Piagetian development can materially affect the results. For example, Irvine (1978) sought to reevaluate the difficulties reported for Greenfield's Wolof (Senegalese) subjects who were asked to deal with a conservation-of-liquids problem. As a part of her assessment, Irvine asked subjects to play the role of an informant whose job it was to clarify *for the experimenter* the Wolof terms for resemblance and equivalence. When confronted with the typical Piagetian conflict situation, Irvine's "psychological subjects" gave the "wrong" response: The beaker with water higher on its sides was said to contain more liquid. However, in their role as linguistic informants, these same subjects went on to explain that while the level of the water was "more," the quantity was the same. Greenfield, herself, had noted that conservation was achieved if the children poured the liquids themselves, suggesting that the European-based procedure was eliciting an irrelevant interpretation of the task (Greenfield, 1966). Glick (1975) has offered a useful general discussion of the ways that language may enter into Piagetian assessment.

A closely related interpretation of culturally linked performance differences on Piagetian tasks is to invoke the distinction between cognitive competence and cognitive performance. Dasen (1977) introduced this distinction into the cross-cultural Piagetian literature, drawing upon a formulation offered earlier by Flavell and Wohlwill (1969). Flavell and Wohlwill had suggested that the correct response to a Piagetian task be considered a joint prod-

uct of the probability that the child has acquired the operational structure and the probability that the relevant task-specific knowledge is applied. To this, Dasen added a third factor identified with cultural factors affecting the probability that the proper knowledge would be brought to bear in "a given cultural milieu."

A major strategy offered by Dasen and his colleagues to address the competence-performance distinction is to conduct training studies, the procedures of which embody a Piagetian theory of the interactions necessary to produce development. For example, Dasen, Lavallee, and Retschitzki (1979) conducted a training study with a large number of Baoulé (Ivory Coast) children, to determine both changes in level of responding to the training task and transfer of training to a variety of other problems requiring the same operations. The central question in this research was to determine if training occurred rapidly and to the hypothetically maximum level. Very rapid and marked effects of training were taken as evidence that the underlying competence existed, but its expression was inhibited. Training in this case was believed to act on the relevant performance factors. Slow learning was interpreted as evidence that the essential competence was initially absent, but instilled by the training. In this study, Dasen and others obtained evidence for learning during the training sessions; the level of performance improved between pre- and posttests. But change was slow enough to best fit the notion that training actually changed the basic competence of the subjects instead of "triggering" an already existing competence. This newly acquired competence transferred to the other appropriate operational tasks. In other studies, change was rapid enough to implicate performance factors, while in some cases training has not been completely successful (see Dasen, Ngini, & Lavallee, 1979).

Dasen (1974, 1980) has sought to provide the most systematic account for performance variability within an overall "ecocultural framework" summarized in Figure 1. Acknowledging the need for methodological rigor in the conduct of studies, Dasen has continued to assume that there are real developmental differences associated with special cultural experience. However, in order to make theory and data fit, he has had to follow that line of Piaget's speculations that relaxed assumptions about the uniformity of developmental levels. (For the most extreme statement of this viewpoint, see Dasen, Berry, & Witkin, 1979.) Working with two groups of Australian Aborigines who differed in the degree of contact they maintained with Euro-Australian culture, Dasen (1974) contrasted performance for two class-

es of concrete-operational tasks. He presented three tasks designed to sample spatial thinking on the grounds that traditional Aboriginal culture depends heavily for its survival on the ability to orient in space using cues deemed subtle and obscure to strangers. These spatial tasks were contrasted with standard conservation of number, quantity, volume, length, and seriation, in which, according to the theory, "logicomathematical" concepts predominate. Dasen cites reports that Aboriginal numerical concepts are few and seldom used, to motivate the hypothesis that tasks embodying such concepts will be learned more slowly by Aborigines than spatial tasks, for which the Aborigines have dense practice and cultural aids. On the basis of prior evidence, Dasen predicts the opposite relation among tasks for the European population tested.

The results of this study confirmed the differences in the age of acquisition of general stages and the differences between cognitive domains, all in the direction Dasen predicted. European contact increased performance of the Aboriginal population for the logicomathematical tasks, and the Aborigines found those problems relatively more difficult than the spatial tasks. Linking within-stage performance variations to environmental variations is an important extension of Piagetian research. In recent years, Dasen has systematically explored a variety of strategies for bringing the European-based theory into line with cross-cultural research while maintaining its basic thrust. (For a recent overview, see Dasen, 1980.)

Culture as Independent Variable

How could it be that certain cultures provide more of the theoretically crucial experiences for development? Are these different experiences to be found in the methods of cultural transmission, the informal and formal educational arrangements of the culture? Are they to be found in the interactional patterns or the technology of the culture? Bovet (1974) suggests that the home life of her Algerian subjects is the source of some of their difficulties in responding to her tasks.

A further point to be mentioned is that the eating and cooking utensils (bowls, glasses, plates) of the particular environment studied were of all shapes and sizes, which makes it somewhat difficult to make any comparisons of dimensions. Furthermore, the way of serving food at the table was for each person to help himself from a communal dish, rather than for one person to share it out amongst those present; no comparison of the

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┌──────────────────┐     ┌──────────────────┐     ┌──────────────────┐     ┌──────────────────┐
│                  │     │ Economic activity│     │Social organization│     │   Childrearing   │
│ Physical ecology │ ──> │    technology    │ ──> │     kinship      │ ──> │    practices     │
│                  │     │                  │     │ division of labor│     │                  │
└──────────────────┘     └──────────────────┘     └──────────────────┘     └──────────────────┘
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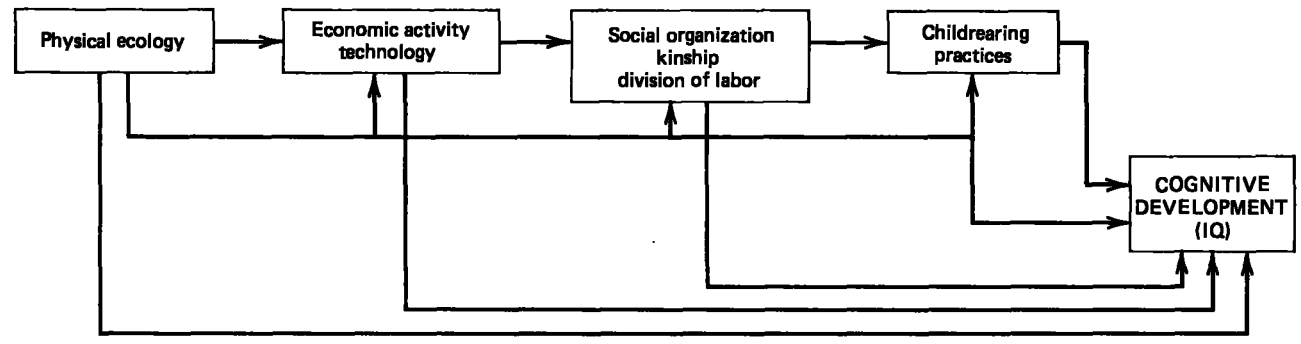
Figure 1. The normative ecocultural theory of culture and cognitive development.

┌──────────────────┐
│   COGNITIVE   │
│   DEVELOPMENT   │
│   (IQ)   │
└──────────────────┘

size of the portions takes place. Finally, the attitude of the mother who does not use any measuring instrument, but "knows" how much to use by means of intuitive approximations and estimations, may have some influence on the child's attitude. (p. 331)

Such features of daily life help to explain both why younger children tended not to notice the dimensions of the containers used in the conservation of quantities task and why children in that culture tended to achieve conservation later than in Geneva.

But, of course, the way food is stored and served is but one of a multitude of differences between the two cultures. Bovet's suggestions are plausible, but they do not distinguish between the contributions of social factors and of equilibration; nor do they "unpackage" the sources of experience that might differentially affect development. Other studies have attempted to narrow down the differences by comparing two groups that differ in a single culture in only one "dimension." Among the comparisons that have been made are those between groups that differ in amount of Western contact, urban or rural residence, socialization practices, and amount of schooling. Even when relevant data are collected, the clearly interwoven nature of Factors 2 and 3, if not 4 as well, lead repeatedly to uncertainty (e.g., Dasen, 1974).

Urban and Rural Settings

We have already mentioned Piaget's reference to a study by Mosheni that compared urban and rural children in Iran. A delay of two to three years on concrete operational tasks was found for the rural children while those in Teheran performed roughly as those in Geneva. It might be tempting to attribute these differences to differential exposure to concepts relevant in the Western technological culture in which Piaget's theory was developed. However, Piaget notes that with the exception of biological factors, it is not possible to specify which of his factors should be implicated in the Iranian rural-urban contrast.

Concerning factor 2, Mosheni notices that astounding lack of activity of the young country children who do not go to school and who have no toys, except stones or sticks, and who show a constant passivity and apathy. Thus one finds at the same time a poor development of the coordinations of individual actions (factor 2), of interpersonal actions (factor 3), and educational

transmissions (factor 4), which are reduced since these children are illiterate. This implies a convergence of the three groups of factors. (Piaget 1974, pp. 305–306)

He calls, therefore, for further studies in which these factors (e.g., education) are more clearly controlled.

More recently Opper (1977) compared urban and rural Thai school children. The two samples differed both in their physical environment and in parental occupations (rice farmers vs. government officials or professionals), but in average school performance the samples were similar. Here, again, the rural children lagged behind the children from Bangkok, but the factors responsible for the delay are not entirely clear. The localities differ both in industrialization (and in the resulting "pace of life"), in childrearing practices, and in the quality of the schooling. Although Opper does not link these variables specifically to Piaget's factors, the first two can be seen to resemble Factors 2 and 3, and schooling should be related to Factor 4. Opper notes that although the Bangkok school was superior in equipment and staffing, the lag between the urban and rural samples decreased during the school years. She concludes that "whatever is responsible for the difference between the two groups seems to have occurred already during the pre-school years . . ." (p. 120).

Western Contact

Dasen (1974) compared Australian Aborigines from two different settlements. Both groups were relatively isolated, but differed in the amount of Western contact. The low-contact group was sedentary for part of the year but for about four months "most of the population still leaves on 'walkabout' visiting their ancestral sacred grounds and performing ceremonies, traveling over wide distances in the Western Desert, and living mainly from hunting and gathering" (Dasen, 1974, p. 383). When not on walkabout, children attend school and adults are employed in jobs that do not intersect the European-based economy; or else they live on welfare. The medium-contact group is somewhat more accessible from the nearest European center. These people travel frequently, but they do not go on walkabout. Both groups use their vernacular at home (schools use English), but the medium-contact group has abandoned more of their traditional values. The jobs held by the second group are of the same type as the first, but they have more contact with a cash economy.

Using batteries of conservation tasks that call on logicomathematical and on spatial skills, Dasen es-

tablished that the rate of development is greater for the medium-contact group than for the low-contact group in the logicomathematical skills but the same for both groups in the spatial skills. It might be expected that the partially nomadic group would develop greater spatial skills by virtue of the practice in hunting and finding their way about the desert. However, Dasen notes that those concepts (conceived as "spatial skills," in other work) which "we are studying are only partly equivalent to those needed for survival by Aborigines (respectively Eskimos), whereas they are the spatial concepts typically relevant to the European culture" (Dasen, 1974, p. 406). Apparently, the skills learned in the desert do not transfer well to Piagetian tasks. (See, however, Kearins, 1980, and Rogoff & Waddell, 1980, which are discussed below.) On the other hand, whatever differences in their lives have been brought about by Western contact do appear to have resulted in some differences in conservation and related abilities.

Schooling
A basic difficulty with interpreting the pattern of cross-cultural data with respect to the influence of schooling on Piagetian concept development is that the theory itself makes no predictions specific to schooling. Clearly, schooling refers to Piaget's Factor 4. But schooling, like any experience, will be expected to promote development of operative understanding only if it provides children with appropriate operative exercises. Different authors have taken different positions on this question.

Greenfield (1966) suggested that schooling increases children's analytic attention to perceptual features of the task and away from the actions involved in the crucial transformations. She also speculates that school may operate indirectly by providing the children with a language (French) that makes distinctions critical to performance and by providing a different set of beliefs that suppress "action magic" interpretations characteristic of her nonschooled subjects. Bovet (1974) disputes these interpretations and attributes Greenfield's results to a kind of "pseudo-conservation." Kiminyo (1977), Armah and Arnold (1977), and Goodnow and Bethon (1966) all argue that schooling should depress the level of operative experience. Goodnow and Bethon and Kiminyo argue that pseudo-conservation occurs among school children because they have been taught procedures specifically applicable to test situations where one does not understand deeply what is going on; nonschooled children have more direct experience with the environment and therefore ought to be more advanced, at least at the concrete-

operational level. Armah and Arnold argue that schooling decreases Ghanaian girls' experience with manipulating objects. All these arguments lead to the prediction of more rapid development among *nonschooled* children. Unfortunately, no differences were found between the schooled and nonschooled populations in overall performance. While the authors seek internal evidence for their hypotheses in the reasons given by individual subjects (e.g., Goodnow and Bethon's), they flounder in their attempts because "performance" and "competence" features of the task demand playoffs against each other: the schooled children are expected to deal more effectively with the "performance" features of the task owing to their greater familiarity with the appropriate discourse forms. These studies did not use the range of techniques suggested by research such as Bovet's, and they remain ambiguous with respect to their theoretical significance.

Strauss, Ankori, Orpaz, and Stavy (1977) found more rapid development of proportional reasoning among unschooled Israeli Arab children up to about 10 years of age. They argue for directly negative effects of specific schooling experience.

One of the most interesting pieces of evidence that culture or task-specific performance factors, not Piagetian competence, underlies differences associated with schooling is provided in a training study by Pinard, Morin, and Lefebvre (1973). Pinard and associates selected a sample of nonconservers on the basis of pretests of schooled and unschooled Rwandian and schooled Canadian 7-year-olds. Control groups did not change their performance over a 2-month period following pretesting. But training that emphasized anticipating the outcome of conservation tests and that provided practice in compensating apparent discrepancies produced a marked improvement in performance; the improvement was equivalent in all the groups. A greater number of unschooled children than schooled children showed an effect of training after only a single session. These results are striking: the fact that so little schooling (the children involved had experienced only 5 months to a year of school) produced an impact on performance and the fact that so little training should remove group differences seem strongly to indicate that these children had a "latent' competence that could easily be "activated" (to use Dasen's, 1977, phrase).

This very brief review of the influence of various experiential/cultural factors on the development of concrete operations illustrates some of the complexities in evaluating the central issue: Does culturally

organized experience influence the acquisition of concrete-operational thinking? (For more extensive discussions, see Dasen 1977; Rogoff, 1981.) At present, it is simply not possible to reach a firm answer to this question. The recent advent of training studies and of more sophisticated clinical interviewing techniques holds out the appealing possibility (from the point of view of the theory) that cultural variations can be attributed totally to performance factors, thus preserving the universalist hypothesis with which Piaget began this work. However, such data are few, and there are enough apparently negative cases (summarized in Dasen, 1977) to urge caution with respect to this conclusion.

With respect to formal operations, the situation is quite different. Formal operations seem to show a greater effect of education than do concrete operations. In fact, if formal operational thinking is manifested at all in Piagetian tasks, it occurs mostly for subjects with substantial levels of education (Goodnow, 1962; Goodnow & Bethon, 1966; Laurendeau-Bendavid, 1977). Laurendeau-Bendavid used concrete tasks as well as a formal one that required quantification of probability with schooled, partially schooled, and nonschooled African children up to 17 years of age. Her comments about this work provide a good summary to this overview.

> In sum, school attendance appears to be a facilitating rather than a necessary condition for the attainment of concrete operations and objective causal representations, since some of the children without any schooling do attain these. On the other hand, school attendance is a necessary but not a sufficient condition for the attainment of formal operations, since only subjects with full school experience—and only a few of these—were found to have reached this level. (Laurendeau-Bendavid, 1977, p. 165)

Evaluating the Four Factors

At the time of this writing, 14 years have passed since Piaget first discussed the relevance of cross-cultural research to his theory. Of the four factors he identified, only biological maturation can be firmly ruled out by his criteria. The factors of equilibration, of social coordination, and of specific education all remain as possible, or even plausible, sources of differences in cognitive development.

This remaining uncertainty does not mean that progress has not been made during this period of intense activity. In our view, a decade and a half of hard work has brought more than a proliferation of

data on cultural variations in performance; it has brought increased theoretical and methodological insights into the examination of the theory itself.

With the wisdom provided by added experience and hindsight, it is now apparent that Piaget severely underestimated the difficulties in replicating his basic methods in different cultural settings. Impediments to implementation of the clinical method amount to more than unfamiliarity with the local language. That can be and has been overcome (e.g., Nyiti, 1976). In addition, researchers have had to come to grips with the fact that the modes of discourse that are the medium for the clinical method are themselves so culturally conditioned (Scribner, 1977) that a variety of new techniques has been required to provide the crucial information to assess the cognitive status of children, and that of adults.

Although this work has greatly enriched our knowledge of the within-experiment factors that modify performance, it has simultaneously complicated the already complicated task of disentangling the factors that contribute to development. If no special procedures are employed to distinguish competence and performance, then Piagetians will still be left with the difficult job of "unpackaging" the independent variables. Piaget's comments in his 1966 paper show clearly his sensitivity to this problem which is, after all, a central justification for engaging in cross-cultural work. But each group included in a comparative study may need to be subject to its own, specially tailored, set of procedures to reveal the bedrock level of competence they have acquired. Then, the fullest enterprise will require not only the study of different cultural groups but a "treatment by groups" design in which different amounts of experimentally designed operative practice must be investigated along with different age levels and different cultural groups.

While moving in this direction, researchers within the Piagetian tradition have adopted two differing views of how culturally organized experience ought to be viewed from the standpoint of the theory.

One view is put forth by Heron:

> By this term [cognitive ambience] I mean "values with cognitive relevance that are *implicit* in the total pattern of adult and older sibling behaviour within which (early) development takes place . . . the total pattern of implicit cognitively-relevant cultural values communicated through linguistic and other behaviour by adults and older children." I must re-emphasize what is the vital feature of this "communication of cognitively-relevant cultural values": it is *the unin-*

tentionality, the day-by-day usualness, the taken-for-granted assumptions about what is and what is not important in life. (Heron, 1974, p. 97)

This view matches well the approach assumed by Piaget in his 1966 article and by Piagetian researchers such as Bovet: there are certain concepts essential to all scientific knowledge structures. Development, which proceeds along a unitary path toward mastery of these concepts, may be retarded if a culture fails to provide the requisite experience. If the problems of assessing basic competence can be solved, it is a relatively straightforward matter to determine if a culture has failed to provide the needed experience.

A second approach has been urged by Dasen. He has opted for a modification of Piagetian theory which assumes that different cultures promote development in "certain areas of cognitive development over others." Dasen tells us, "In other words each cultural group is expected to develop specifically those skills and concepts which it most needs" (Dasen, 1977, p. 184). When he found that the nomadic groups acquired spatial concepts earlier than conservation but that the sedentary group acquired conservation earlier than the spatial concepts, he had support for this line of interpretation.

This kind of result has led Dasen and his colleagues to a new formulation of the cross-cultural Piagetian enterprise: "An ecological formulation provides a value-free context for the interpretation of differences as unique adaptations, rather than as differential developments" (Dasen, Berry, & Witkin, 1979, p. 79). Because this apparently multilineal concept of development is still in its formative stages, a good deal of uncertainty necessarily surrounds its interpretation and its relationship to the initial Piagetian enterprise. For example, Dasen, speaking of the differential development of spatial and conservation concepts in nomadic and sedentary groups, says that the cultural differences he observed "do not exclude the universality of the underlying cognitive competence" (Dasen, 1977, p. 184). But asymptotic performance on some of the tasks reached levels no higher than 20% to 30% of the Genevan levels. In some cases, training studies suggest that the differences apply only to performance, but in others, competence is implicated (Dasen, Ngini, & Lavallee, 1979). These results may or may not conflict with the claim for cognitive universals.

Summary

Despite all of the effort represented by the research that we have reviewed under the rubric of Piagetian theory, the basic question of the universality of cognitive competence has not been satisfactorily answered. Responding to massive evidence of culturally conditioned performance variations, more sophisticated experimental techniques have been devised and tested to rescue a universalist conclusion from the evidence of cultural variability. Especially significant, in our view, is Dasen's move toward a domain-specific theory of development. Whether this modification in the theory can be made while retaining a *Piagetian* formulation of cognitive development is an important question to which we will return after we have had the opportunity to review other formulations of the relation between culture and cognitive development.

CULTURAL CONFIGURATIONS

There is a certain irony in the central place that Piagetian theory has occupied in cross-cultural research on cognitive development. Piaget's earlier theorizing suggested that the crucial environmental prerequisites for development would be very widespread in human societies. Relevant cultural variability would be minimal and located in a few, unevenly distributed institutions such as schools. Before the recent appearance of evidence of cultural variability, cross-cultural Piagetian research seemed concerned with proving the null hypothesis: Culture does *not* cause developmental differences in cognitive structures.

In this section, we review two theoretical positions that assume fundamental cultural variation from the outset—the socialization perspective and the psychological differentiation perspective.

The Socialization Perspective

The "socialization perspective" contains the following propositions: (1) the basic economic activities of a people are constrained by physical ecology; (2) cultures elaborate different kinds of social organization to deal with basic life predicaments; (3) cultures transmit their acquired wisdom to their children in ways that fit in with a culturally elaborated system of adjustments representing adult patterns of living. So, for example, simply as a result of direct

ecological press, the Kalahari bushman and the Kpelle rice farmer will have to develop different strategies for survival of the individual and the group. Even at a very rudimentary level, these activities will have to be coordinated among members of a culture in order to insure an adequate supply of food, shelter, and care of the young.

When we consider the totality of coordinated responses to life's predicaments as they are experienced by different groups living in different physical ecologies with different histories of culture contact, we arrive at the organized human unit that Franz Boas called a culture. In this view, each culture is a "problem-solving unit." The task of cultural analysis becomes one of describing the "problems" set by the environment and the "solutions" evolved over time to deal with the problems. The task of psychological analysis is to establish how patterns of individual adaptation correspond to cultural adaptation.

During the first half of the twentieth century, this kind of thinking produced two major lines of attack against the idea that psychological development would be controlled by universal, biologically determined features of the species.

Perhaps the most celebrated criticism of psychological universals came when Malinowski presented his analysis of father/son relations among Trobriand Islanders (Malinowski, 1927). Contrary to Freud's claim that Oedipal conflicts would be a universal feature of growing up, Malinowski found no evidence of father/son hostility of the kind predicted.

A number of scholars attempted to rescue the Freudian formulation by modifying it to account systematically for cultural variations. One extremely influential approach was suggested by Kardiner, who characterized psychoanalysis as a psychology that attempts to "follow certain gross maneuvers of the personality over the entire trajectory of the life span" (Kardiner, 1945, p. 11). This analysis assumed certain biological constraints that would set universal problems for human infants.

For example, all infants must obtain food, must be kept free of lethal diseases, must get enough sleep, and so on to survive, or the species will expire. These needs are universal, and so are a very general class of adult behaviors that satisfy them (although not without a great deal of pain and loss). However, the specific conditions under which feeding or sleeping can occur will differ rather markedly depending upon the ecological predicament that a culture faces and the socially elaborated responses

that have been accumulated over time to deal with such predicaments. The attempt to save psychic universals in the face of Malinowski's evidence that Oedipal conflicts are absent among Trobrianders retained the idea of universal *functions*, while arguing cultural differences in the form through which functions were satisfied. The "function" of Oedipal conflicts arising from necessary frustration of infant drives will remain constant across cultures, although the "form" it takes will be different from culture to culture. In some societies, uncles or some other adult figures will be the source of authority and the object of negative feelings instead of fathers.

LeVine's (1974) observations among the Gussii of Kenya provide an excellent example of a socialization theory that characterizes the nature of the ecoculturally mediated constraints on children's experience. Gussii cook their food over an open fire; LeVine noticed that Gussii toddlers around the fire could be subject to burned feet. But this hazard doesn't occur in cultural isolation. Parents, recognizing the danger, arrange matters so that their toddlers spend very little time wandering near fires; they carry their toddlers more than we do. Adults recognize that fires represent a special danger that children have to be protected from once they start to toddle, an insight for which they have an appropriate, summarizing proverb, "Lameness is upright." A wide variety of customs dealing with child care, some of which have less obvious connection to specific dangers, all seem to "solve the problem" of letting toddlers walk on their own (as it were).

Generalizing from many such instances in many cultures, LeVine speculates on three nested goals that are universal to all human societies. He then suggests local conditions as reasons for differential organization, with different consequences for the children.

LeVine's three hypothesized universal goals are:

1. The physical survival and health of the child, including (implicitly) the normal development of his reproductive capacity during puberty.

2. The development of the child's behavioral capacity for economic self-maintenance in maturity.

3. The development of the child's behavioral capacities for maximizing other cultural values—for example, morality, prestige, wealth, religious piety, intellectual achievement, personal satisfaction, self-realization—as formulated and symbolically elaborated in culturally distinctive beliefs, norms, and ideologies.

These goals are nested in the sense that number 1 has to be satisfied before number 2 and number 2 before number 3. They also form a rough developmental sequence; physical health and survival are of deepest concern in the first years of the child's life; self-sufficiency and cultural appropriateness come later.

In short, to understand cultural variability, we must consider different ecologies and the special constraints they might impose. Consider, for example, Liberia and its infant mortality rate, which exceeds 50% in some regions. In such places, the physical well-being of the child should be a paramount concern; hence, customs aimed at ensuring survival of young children should organize a good deal of adult activity. By contrast, consider a society in which the infants' environment is not particularly hazardous, but food is scarce. In that case, parents might urge children to be economically self-sufficient at an early age. These variations in adaptations to local ecological conditions produce a different configuration of experiences.

In each case, the pattern of predicaments that the infant faces will be intricately related to the condition of the physical environment and the conditions of the social environment (i.e., the collective set of coordinated behaviors of the adults in the child's life). Belief in the interlocking, contingent nature of cultural facts and personality development is a central tenet of socialization theorists. As Benedict put it in one of the classic statements of this perspective:

> As a cultural anthropologist . . . I started from the premise that the most isolated bits of behavior have some systematic relation to each other. I took seriously the way hundreds of details fall into overall patterns. A human society must make for itself some design for living. It approves certain ways of meeting situations. . . . People in that society regard these solutions as foundations of the universe. Men who have accepted a system of values by which to live cannot without courting inefficiency and chaos keep for long a fenced-off portion of their lives where they think and behave according to a contrary set of values. They bring about more conformity. They provide themselves with some common rationale and some common motivations. Some degree of consistency is necessary or the whole scheme falls to pieces. (Benedict, 1934, pp. 11–12)

A recent description of the contrasting predicaments of Kipsigi (Kenyan) and American (Cambridge) infants by Super and Harkness (1980) further illustrates the force of these considerations. The Kipsigi are an agricultural people living at a relatively low level of technology. Infants sleep with their mothers for many months following birth and are carried in slings on their mothers' backs. There is no special time set aside for sleeping. The rhythm of the workday operates on a flexible schedule that can be modified to the baby's demands. At night the infant sleeps with the mother who is minimally disturbed if the infant wakes to feed.

Babies born to middle-class parents in Cambridge, Massachusetts, have a different set of demands placed upon them. Especially in cases where both parents work, life is guided by the clock. Unconstrained access to the attention of adults (or of older siblings) is out of the question for a great part of the day; and at night there are severe constraints on feeding posed by the unwillingness of parents to spend part of the night awake. The American norm of sleeping through the night is so strong that our pediatricians use the duration of the longest daily sleep episode as a measure of neurological maturation. Babies in the United States who fail to sleep through the night by the time they are 4 months old are suspected of developmental retardation.

These and similar differences concerning the time-boundness of the constraints on individual activity (both adult and child) led Super and Harkness to offer the following speculation:

> The American infant must learn, in effect, to accept impersonal, externally imposed regularity, while the Kipsigi baby is required to adapt to the needs and behaviors of a small number of particular people. A related contrast holds for adult members of the community and their niches. In Kokwet, the difficult deviant refuses to cooperate with family and neighbors and defies the personal mediation involved in local dispute settlement (Harkness, Edwards, & Super, 1977). In America, the adult who is never on time, misses appointments, or chafes at schedules is the troublesome one. More speculatively, the American baby may be learning about external, invariant, impersonal principles, while the rural Kipsigi infant learns to adapt in particular and personalized contexts. Such a contrast, in one form or another, is frequently drawn in comparing patterns of habitual thought and cognitive performance in rural Africa and urban America (Super, Harkness, & Baldwin, 1977). These parallels, it should be noted, do not necessarily imply an inherent stability of psychological traits; the point is rather that cultures may provide a

continuity of developmental niches supporting particular dispositions. (Super & Harkness, 1980)

Valid or not, these speculations provide an excellent introduction to the large research enterprise that relates cultural adaptation to patterns of individual adaptation (Berry, 1976; Dasen, Berry, & Witkin, 1979; Witkin & Berry, 1975).

Psychological Differentiation Theories

One crucial variable linking cultural and individual adaptation is "cognitive style." *Cognitive styles, in this view, represent the pervasive responses of individuals to pervasive patterns of constraint that arise from ecological and cultural adaptations to which the individual must adapt.* Once the concept of a cognitive style is adopted, it is necessary to find a single framework in which both cultural constraints and individual responses can be represented. One such framework is given by the concept of *differentiation*. The most extensive treatment of this approach to the relation between culture and cognition is provided by Berry (1976).

Berry begins his discussion by considering differentiation at the sociocultural level. He cites Spencer's definition of the evolution of sociocultural systems as a starting point: "Evolution is a change from a state of relatively indefinite, incoherent homogeneity to a state of relatively definite, coherent heterogeneity through continuous differentiations and integrations" (Spencer, 1864, p. 216, quoted in Berry, 1976, p. 21). Berry then reviews attempts to create scales of sociocultural evolution in terms of role differentiation, stratification, and the accumulation of cultural elements.

A good case can be made for temporal sequences of sociocultural changes toward greater social differentiation and complexity. However, sociocultural change is characterized by more than temporal differentiation. Even in Spencer's definition, there is the idea of sociocultural differences in integration (coherence and organization of elements). Here the evidence does not support a linear increase, which leads Berry to reject the idea of a single dimension of sociocultural evolution. Instead, by invoking the distinction between specific and general evolution, he sides with Sahlins and Service (1960), who maintain that "adaptive improvement is relative to the adaptive problem; it is so to be judged and explained. In the specific context each adapted population is adequate, indeed superior, in its own incomparable way" (quoted in Berry, 1976, p. 14).

With this notion of sociocultural differentiation in hand, Berry turns to the ideas of Herman Witkin to characterize individual functioning. Witkin employs the concept of individual differentiation in a way that is attractively similar to the idea of sociocultural differentiation that Berry has formulated in a "neo-Spencerian" manner:

In broadest terms differentiation refers to the *complexity of a system's structure*. A less differentiated system is in a relatively homogeneous structural state; a more differentiated system is in a relatively heterogeneous state. The emphasis on "relative" is important for even the most rudimentary system is to some degree differentiated. This is implicit in the very definition of "system."

The description of a system as more differentiated or less differentiated carries definite implications about how it functions. In fact, it is mainly through particular functional manifestations *that extent of differentiation of a system* may be judged. Before the differentiation concept can be applied to the description of individual behavior or the study of psychological problems its implications for function must be delineated.

Among the major characteristics of the functioning of a highly differentiated system is specialization. The subsystems which are present within the general system are capable of mediating specific functions which, in a relatively undifferentiated state, are not possible or are performed in a *more rudimentary way by the system as a whole.*

When used to describe an individual's psychological system, specialization means a degree of separation of psychological areas, as feeling from perceiving, thinking from acting. It means as well specificity in manner of functioning within an area. Specific reactions are apt to occur in response to specific stimuli as opposed to diffuse reaction to any of a variety of stimuli. Parts of a perceptual field are experienced as discrete, rather than fused with their background. Impulses are channelized, contrasting with the easy "*spilling over*" characteristic of the relatively undifferentiated state. More or less discrete feelings and needs are likely to be present. (Witkin, Dyk, Faterson, Goodenough, & Karp, 1962, p. 9)

Just as craft specialization or social stratification may be used as indicators of *sociocultural differ-*

entiation, so various *behavioral* indicators may be used to assess *individual* differentiation. Just as sociocultural indicators of differentiation should cohere, so the individual indicators of psychological differentiation ought to be consistent. As Berry puts it: "[Differentiation] is considered to be a *characteristic of the organism,* and expectations are that tasks which sample differentiation of various kinds of behaviors should yield estimates of roughly similar levels of differentiation" (Berry, 1976, p. 26).

Behavioral Indicators

Key to implementing these ideas is the choice of behaviors that serve as the indicators of differentiation. Differentiation is characterized as a property of "a system's structure," but the referent of the term, "system" is not always clear nor is "structure" clearly specified. In the lengthy passage just cited, "system" sometimes seems to refer to the entire package of individual/environment interactions, sometimes to a subset of interactions that must be investigated in terms of local function, and sometimes to "an individual's psychological system," which can be subdivided into areas labeled by traditional psychological categories (feeling, perceiving, thinking). In order to put these ideas into practice, Witkin's approach was to characterize what he believed to be relevant aspects of organism-in-environment interactions in rather general terms and then to embody these beliefs in psychological tests that appear to have the necessary properties.

Thus, in the area of visual perception, Witkin characterized the relevant characteristics of environment/behavior interactions as follows:

> During development stimulus objects gain function and meaning as a consequence of continuous, varied dealings with them. This acquired functional significance may contribute to the developing discreteness of objects and may serve as the basis for the formation of nongeometrical integrations of the field. We may refer to the increasing discreteness of objects and to the use of more complex principles of field integration as an increase in the articulateness of experience. The person who experiences in articulated fashion has the ability to perceive items as discrete from their backgrounds, or to reorganize a field, when the field is organized; and to impose structure on a field, and so perceive it as organized, when the field has relatively little inherent structure. In this view, the ability to analyze experience and the ability to structure experience are both aspects of increasing articulation. (Witkin et al., 1962, pp. 13-14)

These ideas were embodied in a series of tasks, among which the embedded figures test (EFT) and the rod-and-frame test (RFT) have been most widely exploited. In the EFT, a geometric figure is made a part of a larger design and the subject must locate it. In the RFT, the subject is required to orient a rod "to the vertical." The definition of vertical, however, is ambiguous because the rod is presented within a square frame that can be tilted at various angles with respect to the floor. The key issues are the subject's choice of frame of reference and the physical frame of the tilted square or "true" vertical. Performance of both these tasks is taken as evidence of *perceptual* differentiation. Target items must be perceived as separate from their immediate contexts, and analysis is required to "disembed" the target from the context.

A different set of behavioral indicators are used as indicators of *cognitive* differentiation, which is defined by tasks in which a problem must be analyzed or broken up in order to be solved. Subscales of standard psychometric tests such as matrices, block designs, and picture completion are all said to be measures of cognitive differentiation.

In the *social* domain, differentiation refers to a "sense of separate identity." Witkin suggested three kinds of behavior as indicators of differentiation in the social domain: (1) ability to function with little guidance or support from others; (2) maintenance of direction in the face of contrary social judgments; and (3) stability of self-concept across contexts. The behavioral indicators in this domain have been orientation toward social cues (such as other people's faces), sensitivity to social reinforcers, and preferences for physical distance in social interactions.

The results of correlational studies summarized by Witkin and his associates (e.g., Witkin & Berry, 1975), which suggest consistency of behavior across the indicator tasks, provide the justification for using the concept of "cognitive style" as a link between psychological and cultural adaptation.

Although it would be possible to pursue the study of culture and cognition within a differentiation framework simply by correlating indicators of sociocultural differentiation with indicators of individual differentiation, such evidence would still leave open the question of how cultural experience is transformed into individual behavior. How does the individual come to experience the constraints of the world that mold cognitive style? And, vice versa, how does cognitive style become amalgamated into the totality of coordinated responses to similar experiences?

To answer such questions, Berry and Witkin fol-

low the precedent of the socialization theorists; they look to the early social environment of the child for information about the pattern of constraints that require more and less field-independent, differentiated behavior by the child. In developing indicators of these socialization practices, Witkin has suggested that investigators look at the way that mothers circumscribe their children's activities, whether they regard children as delicate or sturdy, whether they stress conformity and look to the beliefs that they hold about themselves that would affect their behavior toward their children.

Berry (1976) used two different techniques to obtain indicators of the restrictiveness of socialization. First, he used a scale of "compliance-assertion" that had been developed by Barry, Bacon, and Child (1957) to relate child-training techniques to economy and sex differences in socialization (see also Barry, Child, & Bacon, 1959). Barry and associates constructed their scale out of ratings in six categories of interaction involving childrearing. These included obedience training, responsibility training, nurturance, achievement, self-reliance, and general independence training. Using the Human Relations Area files, which contain cross-referenced entries on a wide variety of cultural characteristics, they obtained significant relations between economic activities and socialization practices: compliance increases as food accumulation increases. Second, Berry used a self-appraisal procedure by asking his subjects to rate their own socialization: "When you were growing up, did your mother (father) treat you very strict, fairly strict, or not so strict?" Data generated from these two measures of restrictive socialization practices, which were highly correlated, were combined into a standardized socialization score.

Berry measured ecological factors by using Murdock's classification of subsistence societies in terms of exploitative pattern (animal husbandry, agriculture, etc.), settlement pattern, and size of communities. Acculturation factors were measured by indices that included levels of wage labor and education. Socialization was measured by ranking political and family organization.

Results

With the exception of education and socialization self-ratings, indicators relevant to the ecocultural part of the theory were gathered for 18 subsistence cultural groups ranging from West Africa to Northern Canada to Australia and to three industrialized groups. Data from the Human Area Files were used to code the information about ecological, acculturative, and cultural elements that had been related the-

oretically to sociocultural differentiation. Tests of cognitive style and some control tests were administered to samples within each cultural group. Then the relationships among variables were calculated by using correlation, analysis of variance, and multiple regression techniques. Berry summarizes the results as follows:

> There is systematic covariation between the set of independent variables and the differentiated and acculturative stress behaviors. Cultural groups [and individuals] which are hunting and gathering in subsistence pattern, nomadic in settlement pattern, and loose in sociopolitical stratification emerge as clearly different in cognitive style from those which are agricultural, sedentary, and tight. And within this range of ecological and cultural adaptations, those which occupy intermediate positions ecoculturally also exhibit intermediate behavioral adaptations. . . . Taken at the level of a general overview, it is difficult to avoid the conclusion that the hypothesized relationships have been confirmed. (Berry, 1976, p. 200)

These generalizations have been bolstered by similar studies conducted in many parts of the world on many different populations (see Werner, 1979, for a recent review), making the Berry-Witkin approach to culture and cognitive development one of the most widely tested.

Doubts

Despite these attractive features, there are a number of reasons to question whether the theoretical relationships are either as strong or as broad as they appear to be. One of the major questions raised in recent discussions of the psychological differentiation/cognitive styles research is the issue of domain consistency. The use of the term "style" is motivated by the claim that differentiation manifests itself in all areas of psychological functioning. Thus, key behavioral indicators of field independence and field dependence should cluster within domains (perceptual, cognitive, social, affective) and should correlate highly across domains.

As other writers have noted (e.g., Jahoda, 1980; Werner, 1979), the evidence of domain consistency is not at all strong when one moves from the perceptual and cognitive tasks to the social and affective indicators. Although domain consistency is claimed for intracultural data from the United States, the failure to obtain expected correlations in the cross-cultural arena is considered a problem not only by others but by researchers who take the psycho-

cultural differentiation research perspective (e.g., Dassen, Berry, & Witkin, 1979; Witkin & Berry, 1975, pp. 29–30). There is still the apparent consistency across perceptual and cognitive domains to be considered, however.

Berry, himself, suggests a narrower interpretation of his results because of the difficulty in assigning task to domain.

> In cognition (where perception is also inevitably implicated) differentiation involves the ability to break up or analyze a problem as a step towards its solution, in addition, of course, to many other components (such as background knowledge, general competence, etc.). (Berry, 1976, p. 28)

Goodenough and Karp (1961) are of the opinion that standard psychometric tests such as block designs, picture completion, mazes, and puzzles "appear to involve a capacity to overcome embeddedness." With this justification, supplemented by references to other tasks such as conservation and concept attainment, the separateness of perceptual and cognitive domains is established.

As Jahoda (1980) comments, the lack of process specification creates problems in attempts to evaluate the theory. Nowhere is this truer than in trying to decide if the tasks used to represent cognitive and perceptual domains are sufficiently distinct to warrant the use of the term "cognitive style" when intertask correlations are observed. This issue takes on an added significance in evaluating generalizations from the data because Kohs's blocks and Raven's matrices are widely accepted in American psychological research as indicators of intelligence. (Morrisby's shapes are out of the same mold.) Berry has refused to accept these indicators as valid, but in the absence of a process theory of performance on these tasks, it poses a problem for claiming *differentiation* as the process variable linking individual and cultural adaptation. A "perceptual" task such as the EFT appears to be no less cognitive than any of the cognitive tasks."

Our own view is that evidence of domain consistency is less convincing than current discussions suggest, even for the perceptual and cognitive domains. Serpell (1976) reviewed several such studies and proposed that Witkin and Berry's "cognitive style" is really an increased skill in dealing with pictorial stimuli. For example, Okonji (1969) found the expected correlation between EFT and Raven's matrices, but he failed to find that these two tests correlate with the rod-and-frame test. Okonji also failed to find the expected correlation between EFT, RFT, and socialization factors (see also Siann,

1972). In Berry's study, the rod-and-frame test correlated least with the other measures of field dependence and not at all with measures of socialization or education.

These issues of domain independence and the strength of existing evidence for the theory force themselves on us in two ways. First, they are important to claims that differentiation (disembedding) is the process implicated in the pattern of performance. Berry quite properly included in his battery a test of perceptual discrimination as a process "prior to disembedding (and separate from it . . .)" (Berry, 1976, p. 146). Geometric shapes with gaps in them were presented tachistoscopically and a discrimination score was assigned on the size of a gap necessary to produce recognition. Subjects responded by drawing the figure they saw.

The logic of Berry's analysis leads us to expect that performance on the discrimination task will not correlate highly with performance on the disembedding tasks and will not correlate well with the predicted antecedents of disembedding. Only the first of these expectations is supported by the data; discrimination performance is not as highly correlated with the disembedding tasks as they are with each other, although the correlation is substantial. But discrimination *is* highly predicted by major antecedents. In some cases it is predicted as well as the disembedding task. In light of the truncated range of these scores owing to subjects deleted because they could not draw, the success of the independent variables in predicting discrimination performance is a problem of the sort that motivates a perceptual skills interpretation. According to Berry's statements about the priority of discrimination in the perceptual/analytic process, it would have been interesting to see tests of the effect of ecocultural antecedents with discrimination performance partialed out. No such analysis is offered.

A second concern about the extent to which the implicated *differentiation* is the major process variable controlling performance is the way in which performances generate the classification of subjects in terms of the "cognitive style."

For a task like the rod-and-frame test, the analogy relating performance to process is relatively clear: field independence is indicated when the subject ignores the wooden frame and sets the rod upright with respect to the ground. Field-dependent subjects "depend" on the wooden frame. There are no right or wrong answers, simply different sources of information used to deal with an ambiguous situation.

But for the other tasks used by Berry, there are clear "right" and "wrong" answers. There seems

to be no alternative to labeling the performance of someone who cannot identify any of the hidden figures in the EFT as "poor." Certainly when used as psychometric tests, performances like those of many of Berry's groups are so labeled, and so educational researchers focus on remediation through "direct [and] vicarious experiences encouraging conceptual development" (MacArthur, 1973, p. 24).

This close identification between performance on the various indicators of perceptual/cognitive skills is echoed in a recent, comprehensive study of culture and child development: "Studies in both the Western and developing world have shown that children progress from relative field dependence, in which their perception is dominated by the organization of the surrounding field, to relative field independence . . ." (Werner, 1979, p. 187). One might be tempted to conclude from these and similar remarks in the literature that "field dependent" and "less developed" are in some way synonymous, at least within the confines of differentiation theory (Scribner & Cole, 1978). Less differentiated people, like young children, perform poorly on a variety of perceptual/cognitive tasks.

It is this web of factors, vitiating claims of inter-domain consistency and mixing tasks interpreted as having "right" and "wrong" answers with tasks having different kinds of answers, that leads us to prefer the idea that Berry and his colleagues have been dealing with a less pervasive set of individual accomplishments than their theory commits them to. By using behavioral indicators that have clear implications of "higher" and "lower" levels of performance, they leave open an interpretation that links field dependence (the "style" that generates low performance) to lower stages of development.

Dasen, Berry, and Witkin (1979) strenuously object to this implication being drawn from their work. They divorce differentiation theory from implications of "higher" and "lower" levels of development by distinguishing between general and specific evolution and by choosing the specific evolution option according to which adaptive improvement is judged by the adaptive problem. This strategy has led cross-cultural differentiation theorists to suggest that the field-dependent and field-independent styles are adaptive to different environments:

> Relatively field-independent people are better at cognitive restructuring tasks—that is, tasks which require the person to act on percepts or symbolic representations rather than to adhere to their dominant properties as given. . . .
>
> Relatively field-dependent people are more sen-

sitive . . . to social cues provided by others; they choose to be among others which gives them more experience with people; they have characteristics which are likely to be helpful in relating to other people such as having an interest in others, wanting to help others, and having concern for others. (Dasen, Berry, & Witkin, 1979, pp. 71, 72)

This domain specificity of the adaptiveness of the two styles allows Dasen and others to characterize the theory as "bipolar" and "value free."

Although the claim is not made explicit, it appears that this most recent statement of the theory conceives of societies as either "people oriented" or "object-symbol oriented" in varying degrees that are complementary to each other.

> The proposal is that the field-dependent and field-independent cognitive styles, which are process variables, influence the development of patterns of abilities—in this instance, cognitive restructuring skills and interpersonal competencies, combined in an inverse relationship. (Dasen, Berry, & Witkin, 1979, p. 72)

This is an interesting suggestion. However, its empirical basis is very shaky because it rests heavily on claims about domain-specific patterns of reciprocally adaptive behavior that no one else claims in any cross-cultural developmental work. Needed are "bipolar" tasks (such as the RFT) that sample each of the domains in question, and subjects who do well in one domain but poorly in the other *while maintaining the same cognitive style*.

A thought experiment can illustrate how difficult such empirical tests may be. Eskimos are often characterized as field independent. Their talents, therefore, would seem to lie in the cognitive restructuring domain. But do we want to claim of Eskimos that they have less "experience with people," less "interest in others," less "concern for others" than the Temne? Do they have less ability to deal with people than with objects? And if we want to make such claims, how should we establish their validity?

Existing guesses about the real-world analogies for Berry's perceptual tasks also indicate sources of uncertainty in the presumed validity of the perceptual tasks. Berry offers his gap-detecting discrimination task as an experimental analogy to the task facing a hunter: "For discrimination disembedding is not involved; rather the task is to detect an element from a fairly simple gestalt . . ." (Berry, 1976, p. 147). But Wagner (1978), noting the precociousness of 7 to 8-year-old Berber sheep herders on the EFT,

surmises: "One might hypothesize that these boys, who are Berbers and who were raised as shepherds before they went to school, had developed certain perceptual skills (such as location of sheep in a variegated terrain) . . ." (Wagner, 1978, p. 150).

Yet another concern is the relationship between psychological differentiation theory (as a theory of individual differences) related to experiences within cultures and the data offered in the cross-cultural literature. Berry (1976) offers analyses at both the individual and cultural levels of analysis. Or so it appears. However, when one considers the nature of the independent variables, it is quickly apparent that, with two exceptions, *the same independent variable codes must apply to all subjects within a cultural group*. The exceptions are years of education and self-rated strictness of childrearing.

Cognizant of this problem, but limited in his ability to carry out within-culture analyses owing to limited variation in the ecocultural index within the cultures, Berry presents within-culture analyses for each group; he relates compliant socialization self-ratings and education to cognitive performance (Berry, 1976, pp. 155–157). Although substantial correlations between cognitive performance and education are obtained, correlations with the socialization index are variable and quite low on the average, in sharp contrast to the general picture given by the between-culture analyses.

The work of Irwin, Engle, Klein, and Yarbrough (1976), who studied the relationship between EFT performance and mother's traditionalism, also suggests that failure to provide within-culture evidence may give a false picture of the factors at work. Similarity of items on their traditionalism scale and Witkin's characterization of the antecedents of field dependence had led them to hypothesize a positive relationship between traditionalism of mothers and field dependence of children. No such relationship was found by Irwin and others. However, ratings of sources of intellectual stimulation did predict EFT performance. Irwin and colleagues argue that Berry's previous research linking field dependence to traditionalism was confounded by variables such as availability of intellectual stimulation.

Summary

Despite the large amount of evidence put forth in support of its basic claims, we remain skeptical about the strength of the psychological differentiation theory as an account of culture's influence on cognition. Our concerns about the claims of this theory are as follows:

1. Evidence of domain consistency may be illusory because the domains in question are either:

a. Not conceptually distinct although they are claimed to be (as, in this case, the perceptual-cognitive contrast), or

b. They do not provide interdomain consistency where distinctiveness of the domain is clearly plausible (as in the lack of EFT/RFT correlation in studies cited).

2. The absence of process specification makes identification of domains ad hoc, or post hoc (e.g., dependent upon response patterns).

3. When process distinctions are made (e.g., the discrimination task), task performance may be predicted as well by control tasks as by the crucial experimental tasks.

4. The bulk of the cross-cultural data relies on between-group data; where within-culture data are available, they fail to confirm the theory.

Our doubts should not lead the reader to conclude that the basic approach linking cultural configurations to configurations of individual cognitive functioning is wrong. Rather, the data in support of specific implications of these ideas are subject to more difficulties than a casual reading of the literature might suggest.

CONTEXT-SPECIFIC APPROACHES

Both the across-culture/universal and within-culture/universal theories emphasize the common processes that can be used to interpret diverse experiences, thus producing coherence in behavior. These theories see as typical cases the following: A child who recognizes that pushing a lump of clay out of shape does not change the amount of clay is a child who knows that pouring water into a different size container does not change the amount of water. Similarly, people who depend upon a tilted frame to define "vertical" are expected to depend on other people for help in defining what is going on and what to do about it in social situations.

This "coherence" assumption was not characteristic of American learning theory in the middle of this century. Influential researchers such as Tolman, Hull, and Skinner evolved very general theories of learning by using very specific tasks as model systems to test the theories. It is a common complaint that each system has its own set of tasks so that no theorist has an easy time accounting for the (tailored) phenomena of a rival.

Some Early Observations

The failure of interdomain coherence as a central organizing principle of behavior is one of the significant characteristics that led to the research program initiated by John Gay and his colleagues in the mid-1960s (Gay, 1973; Gay & Cole, 1967). Gay had begun his work in an effort to pinpoint difficulties that Kpelle (Liberian) children experience when required to master mathematics in American-style schools. In Liberia, like the United States, school difficulties were explained in terms of cognitive skills that seemed to be deficient or lacking. As in America, these deficiencies were related to aspects of the children's home environments. So, for example, it was claimed that Kpelle children have a difficult time discriminating elementary geometric figures such as triangles and squares owing to a lack of perceptual stimulation. This "perceptual deficit" rendered the children virtually helpless when it came to constructing objects or pictures from tinker toys or jigsaw puzzles. There was a great deal of discussion about "African" reliance on rote memory and many other anecdotes about cognitive deficits and their hypothesized origins in Kpelle cultural practices. In each case, a process deficit was linked to *general* features of Kpelle experience.

However, Gay and Cole were forced to conclude that they were dealing with a culture that manifestly produced adults competent in its *own* terms. The juxtaposition of competence and deficiencies allowed Gay and Cole to make a distinction that became characteristic of a good deal of the later work in this tradition. Granted that Kpelle children lack particular kinds of experience that their educated brethren or middle-class American children routinely encounter, Kpelle children are by no means lacking in experience. Gay and Cole decided that it would be necessary to investigate directly Kpelle experience that might represent useful background knowledge for any particular set of skills to be included in the school curriculum. Because mathematics was the area of experience that their project was aimed at, they set out to "know more about the indigenous mathematics so that we can build effective bridges to the new mathematics that we are trying to introduce" (Gay & Cole, 1967, p. 1). The problem, then, became one of discovering through a study of Kpelle activities those that involved one or more elements that would be recognized as relevant to American educators' notion of mathematics, especially those mathematical skills that Liberians wanted to teach more effectively in their schools. Gay and Cole explicitly assumed variability of expe-

rience across different life activities with respect to psychological processes.

In exploring the domain of measurement among the Kpelle, Gay and Cole discovered that well-articulated systems of measurement applicable to many problem domains are rare or nonexistent. Each kind of commodity, or each potential "measurable," is dealt with by using a unique system of units. The Kpelle have no well-articulated theory relating, for example, volume or length for a wide variety of materials. They measure length using one of several units, but the appropriate unit is usually associated with a particular kind of material or range of lengths. Cloth is habitually measured in armspans; so are ropes. Another unit, handspans, is used for smaller items like a table top. Footlengths replace handspans for some distances, such as a grave or a floor.

What is striking about these perfectly reasonable-sounding "rules of thumb" is that they are neither standardized nor related to each other in any systematic way. They are different ways to find out how much there is of some quantitative dimension. But there is no single *system* applying to large measurement. When asked to estimate various lengths using each of the possibly applicable metrics (handspans, footlengths, etc.) people were relatively inaccurate and inconsistent when compared with a group of relatively poorly educated Americans. The Americans appeared to mediate their measurements using inches, feet, and yards.

On the basis of these observations, it might be tempting to concede that the Kpelle "have no concept of measurement." However, any such conclusion would have to be tempered by observations that Cole and Gay made concerning measurement of volume, in particular, the volume of rice in various containers.

The Kpelle are rice farmers whose production methods are barely sufficient to get them through the year. In fact, it is not rare for farmers to cut the margin between savings and consumption so close that they experience a "hungry time" just prior to harvesting a new crop. When Gay and Cole investigated measurement in the domain of rice they found a very different picture from that given by their studies of length.

The Kpelle use a system of units applying to rice at the farm, and then a second set of units that applies to rice as a consumable commodity, once it has been threshed. The basic measure in this latter case is the *kopi* (cup) made of a U.S. #1 tin can, which contains almost exactly two English measuring cups. Cups may be aggregated into larger units called tins

and tins can be aggregated into bags. Tins contain about 44 cups; these can be aggregated into bags which contain somewhat less than 100 cups. At least at a rough order of exactness, an interlocking scale of units of the sort that we associate with measurement exists among the Kpelle in the case of volume of rice.

An idea of the precision of measurement routinely used for the small amounts of rice used in daily commerce is given by the alternative measuring instruments for a cup. When selling rice to a merchant, the farmer must use a cup provided by the merchant in which the bottom has been pounded down to increase the cup's volume. When buying back rice later, in the frequent and unhappy event that he has not saved enough rice to get to the next harvest, the farmer must use a cup with a flat bottom. The difference in volume is the prescribed margin of profit (which is actually much greater because the farmer sells when prices are low and must buy back when prices are high).

The different cultural experiences with measurement implied by different degrees of precision and differentially developed measuring systems for rice were tested by Gay and Cole in a series of estimation tasks. When Kpelle farmers were contrasted with American subjects of working-class background, the Kpelle were considerably more accurate in estimating the amounts of rice in several bowls of different sizes containing different amounts of rice. Gay and Cole's summary of these results is instructive.

> The most important thing is that measurement is used where it is needed . . . units of measure are, in general not parts of an interrelated system but are specific to the objects measured . . . measurements are approximate unless there is a real need for exactness [and] . . . measures are made quantitative primarily in economic activities. (Gay & Cole, 1967, p. 75)

These conclusions hardly appear startling. But in 1967 they contrasted strongly with the expectations of the times, when coherence in the level of intellectual functioning owing to the application of general cognitive processes was strongly believed in. From that point of view, lack of sophisticated intellectual behavior in one domain led to an expectation of similar lack in others.

A somewhat different, and in a sense more extreme, example of restricted application of an ability was found by Cole, Gay, Glick, and Sharp (1971) in one of their psychological studies of cognitive abilities among the Kpelle. The psychological domain this time was classification, one of the domains about which it is often claimed that tribal African people experience great difficulties. On the basis of pilot work, it was evident that Kpelle people, forest-dwelling rice farmers as they are, have a deep knowledge of the local flora and fauna. Mastery of this knowledge is not a trivial matter. Cole and associates sought to study classification of leaves in a concept-identification task by using two sets of leaves for which Kpelle have well-marked categories. The research was impeded because it was difficult for the American researchers to keep from mixing up the leaves!

The actual experiment involved vine leaves and tree leaves, according to the Kpelle system of classification. In the morning, the research assistant went out to collect 14 leaves; 7 from vines, 7 from trees. These leaves were presented to the subject one by one. The subject was asked to sort the leaves into two classes, according to a criterion the researcher supplied. Feedback was provided and the subject was asked to again sort the objects into the same two classes.

One group was asked to say if the leaves were from trees or from vines. A second group was also expected to make the "tree/vine" classes, but no mention was made of trees and vines. Instead subjects were told that "Some of these leaves belong to Sumo and others belong to Togba." Their job was to name the owner of each leaf as it was presented. In a third group, vine and tree leaves were mixed to form two pseudocategories. Again, subjects were told that half belonged to Sumo and half to Togba. But now there was no real world relation (like tree and vine) to help identify which leaves Sumo and Togba owned.

Overall, the Kpelle subjects mastered this task faster than American college students teaching in Liberia. But the most striking fact was that the Kpelle adults learned very rapidly *only* if the two classes to be formed were called "vine" and "leaf." When asked to name the leaves "belonging to" Sumo and Togba, learning was no faster for the real category than the pseudocategory. The American subjects showed no evidence of categorical learning at all; in fact, they had trouble telling one leaf from another, let alone establishing a response rule (category) for each leaf. In this study the Kpelle subjects clearly manifest knowledge of and use of a cultural category, yet *only when that category is explicitly named.*

Such evidence of very specific localization or context boundness of culture-dependent cognitive skills is by no means restricted to these few examples. Research during the past decade and a half strongly suggests the context-boundness of behavior that is often interpreted in general terms.

In the next section we review a variety of cross-cultural studies of cognition in which the preexperimental expectation (based on common observation, school performance, or test results) has suggested some rather general cognitive differences between cultural population groups. Alternative explanations are then tested in one or a series of studies exploring the relation between the specific activity constituting "the test" and relevant cultural knowledge.

Examples of Context-Specific Research

The general procedure for (if not the logic behind) cross-cultural studies is for a researcher to administer a test or battery of tests to a group of subjects. The test (experimental task, observation) is used as an index of the psychological process believed to control performance. Indices are then compared across cultures. The levels and patterns of performance on the indicator tasks are compared *as if* these performances mean the same thing across populations (e.g., index the same covert activities) and *as if* these performances sample equivalently the designated area of psychological processing with respect to people's everyday experiences.

In the context-specific approach to culture and thought, the "methodological" problems, glossed by *as if*, become the center of theoretical focus. Cultural variation in performance becomes an invitation to discover the relation of tested performance to prior cultural practice. After reviewing several examples of such work, we will turn to the important question of how to reconcile conflicting evidence of culture-general and culture-specific cognitive development within a single analytic framework.

Infancy and Motor Development

All of the measurement problems and questions about the generalized nature of developmental patterns can be seen in the earliest assessments of infants, raised in different cultural settings. A number of different assessment techniques (Bayley Motor and Mental Development Scales, 1965; Neonatal Behavior Assessment Scale as developed by Brazelton & Associates, 1974; Gesell Scales, revised by Gesell & Armatruda, 1947) sample infant behavior and arrive at a general index of both mental and motor development. Scales typically include such items as: age of walking, crawling, smiling, responding to negative signals, pulling strings to get objects, placing objects in containers. In within-culture studies, one infant is said to be more mature or advanced than another if he or she receives higher scores on these scales. In cross-cultural comparisons, one group of infants is said to be more mature or advanced than another if their mean scores on these scales are higher. Such evaluations have led some researchers to claim an early and general precocity in the mental and motor development of infants from sub-Saharan Africa (Geber, 1974; Geber & Dean, 1957, 1958; for review, see Munroe, Munroe, & Whiting, 1981; Super, 1981; Wober, 1975). While it is claimed that African infants have a head start in development during their first year, it is found that they drop below Western standards in their second or third year.

Super's review of infant development based on such infant development scales entreats the reader to consider carefully the relationship between the specific items used on scales of development and their relationship to the cultural system in which they are embedded. Using spot observations of East African mothers and infants, as well as interviews with the mothers, Super (1976) reported that the Kipsigi (Kenya) make a conscious effort to teach babies to sit and walk; they use standardized procedures for this instruction and employ particular words in their language for characterizing the process. For example, babies are placed in a hole in the ground with blankets, rolled up to provide support. Infants are left in this "sitting" position long before they are able to sit on their own. Super's observations showed that the Kenyan infants are in the sitting position two-thirds more often than infants of comparable age in Cambridge, Massachusetts. As early as the second month of life, walking skills are also exercised; infants' arms are held and they are encouraged to jump. This particular behavioral practice is very similar to the test item found on the Bayley motor scales which is used to indicate readiness to walk, a "developmental milestone."

In summarizing his findings and those of others, Super (1981) concludes that African infants are only more advanced in those behaviors that (1) are specifically taught, (2) are encouraged by providing opportunities for practice, or (3) are both taught and encouraged. The early advancement of particular motor milestones does *not* mean that all motor behaviors are also advanced. For example, the group of Kipsigi infants who were found to sit and walk

early, learned to crawl several weeks *later* than the norms established by U.S. infants. It is also the case that these infants spend only a third as much time on the ground as Cambridge infants. The relative importance of a particular behavior and the amount of time that infants are afforded opportunities for practice are reliable predictors of the onset of particular motor milestones.

Another somewhat unusual example of culture-specific learning concerns sleep. It is an instructive example both because sleep is ordinarily considered so close to a biological universal and because of the implied universality of its main characteristic links to everyday life. Super and Harkness (1980) provide an unusual comparison of the sleep/wake cycles in infants in rural Kenya and the urban United States. The length of the infant's longest sleep period (occurring most often during the night hours) has been accepted as a behavioral index of the neurological maturity of the brain. By the third or fourth month, American infants who are developing normally are expected to have maximum sleep periods that last on the average 8 hours. Another assumption about the normal pattern of infant development is that as the infant becomes more mature, less hours of sleep will be necessary. These developments in the infant's sleep/wake cycle have been assumed to be regulated by the infant's needs and not highly influenced by cultural factors. Sleep patterns for Kenyan and American babies are relatively similar during the first months. But after that time, U.S. babies come to sleep more total hours in different patterns than the Kokwet babies in Kenya. By the fourth month, the Kokwet babies are awake on the average of 2 hr. more than the American babies in any 24-hr. period.

Another change is that between the third and fourth months of life babies in the United States begin to concentrate their sleeping into fewer and longer bouts so that the longest single period of sleep lasts on the average 8 hr. and roughly coincides with the sleeping patterns of adults. This is not the case with the Kokwet sample. They continue to have maximum sleep periods of about 4 hr. throughout their first year of life. As mentioned when this work was described in a previous section, these differences in sleep/wake patterns are paralleled by differences in adult structuring of the infant's experience. The caretaking patterns in Kenya arrange for babies to be carried frequently in slings by the mother or some other family member. The productivity of the mother is independent of the sleep/wake cycle of the baby so long as the baby does not become too active, in which case carrying in the sling is impossible. Babies sleep in skin-to-skin contact with their mothers who sleep, except for the infant, alone. The

mother's sleep pattern is only minimally disturbed by a baby who is awake or nursing.

The difference in these two cultural groups controls the contexts that in turn shape the development of behaviors that are assumed to be determined by biological needs within the limits permitted by biology—limits that seem to be much broader than previously believed, in this case.

Super's "context arrangement" interpretation of culture and infant development is supported by a longitudinal research project that demonstrates an empirical correspondence between patterns of specific item precocity in Uganda infants and the culture's child-care practices (Kilbride & Kilbride, 1975). The Kilbrides related the frequency of being in the supine position to early grasping and manipulative behaviors; frequency of being carried at shoulder level was correlated with performance on a task of visual skills; cultural emphasis on early smiling and social behaviors was related to early smiling.

In reviewing the studies of cultural variations in the assessment of infant mental development, Super concludes that, except for conditions of minimal stimulation and/or malnutrition, there is *no* cultural group that shows more rapid *general* cognitive development than another. The literature does, however, provide a number of examples of environmental influences on particular behavior items (Grantham-McGregor & Hawke, 1971; Kilbride & Kilbride, 1975; Leiderman et al., 1973). Because of this relationship, Super challenges the usefulness of standardized psychometric tests in cross-cultural research, a critique that resonates with the ideas expressed in this paper:

> Their future use [of standard psychometric tests] for the purpose of group comparison seems inefficient, at best, because of the enormous amount of detailed empirical work required to explain adequately the pattern of item difference. Only after this Herculean task has been finished can attention be turned to fundamental issues of experiences and development. (1980, p. 106)

In summary, "performance" is used to make general claims about the overall state of infant development; if specific behavioral accomplishments in a culture have been isolated and the infants therein given opportunity and encouragement to practice skills that are components of those specific (and highly prized) behavioral accomplishments, then such infants will be evaluated as "more advanced" or as "having more" of the ability in question than those infants who live in cultures that provide infrequent opportunity and encouragement to practice

such component skills or that evaluate the specific accomplishments indifferently.

Perceptual Skills

A number of studies of the behavior of older children relate specific cognitive change to specific experience, the basic assumption of these studies being that supposed differences reflect some underlying general mental ability. Just as early research produced reports of a general motor precocity in African infants, so a sizable body of research now suggests that rural or uneducated African children perform less well than other groups of similar age on pattern reproduction tasks using either pen-and-paper or block designs. Performance on these tasks is often interpreted as indexing the presence or absence of general cognitive abilities: differences in "practical intelligence" (Vernon, 1969); in "cognitive style" (Witkin & Berry, 1975); in "attitudes toward perception" (McFie, 1961); in "sensotypes" (Wober, 1966); in "imagined transformations" (Goodnow, 1969); or in "response organizations" (Serpell, 1969).

These general characterizations of mental ability are then commonly related to general environmental contingencies. Vernon (1969) suggests that retarded practical intelligence is the result of "inadequacies of psychomotor experience . . . and the absence of interest in constructive play or cultural pressures to practical achievements." As we have already mentioned, Witkin and Berry (1975) attribute the field-dependent cognitive style to a complex of environmental relationships but particularly to "the use of strict or even harsh socialization practices to enforce this conformance and by tight social organization." McFie (1961) suggests that "the lack of toys and constructional games which might encourage a more accurate standard of orientation and imitation" are the cause of the perceptual differences he observed.[5]

Suspicious of such inferences, Serpell (1979) designed a study to distinguish between generalized and specific interpretations of representational ability. He selected four perceptual tasks that should all result in lower performance scores for Zambian children than English children, if some general aspect of these children's predicament was responsible for a failure of perceptual abilities to develop. One task required children to copy the positions of the experimenter's hands (mimicry); the second involved copying two-dimensional figures with pen and paper (drawing); the third involved constructing copies of two-dimensional wire objects with strips of wire (molding) and the fourth involved making copies of three-dimensional objects from clay (modeling).

Serpell chose precisely these four tasks because he knew something about the prior experiences of each of the cultural groups on the specific tasks; he based his predictions concerning patterns of cultural differences on function-specific hypotheses linking the role of the model task to known activities in each group. Since skill learning in any culture requires children to attend to and imitate the hand positions of the more competent members, both English and Zambian children should do equally well on the mimicry task. Children in both cultures also had experience modeling with clay, so no differences were expected for that task. Two-dimensional representation with pen and paper is an activity that English children frequently engage in, while Zambian children will have had more practice forming wire into two-dimensional objects, a common activity for them. Therefore, Serpell predicted that the English children would score high on the pen-and-paper task, but not as high on the wire-shaping task. He made the opposite prediction for the Zambian children.

Serpell also wanted to investigate a different kind of general process claim (Wober, 1966) that African subjects process information from different senses in ways that are different from Europeans. For both groups of children, he established a "visual" condition and a blindfolded or "haptic" condition. According to Wober's hypothesis, the Africans should perform better in the "haptic" condition while Europeans should perform better in the visual condition.

The major comparisons were drawn between 8-year-olds in the second grade in Zambian and English primary schools.

The findings support the context-specific hypothesis and present evidence that is difficult to interpret from a general perceptual-deficit approach. The English children did better than the Zambian children in the drawing task and the Zambian children did better in the wire-molding task. There were no significant differences between the groups on the clay-modeling or hand-mimicry tasks. The modality of the task, visual or haptic, did not result in any differences. Contrary to a "sensotype" interpretation between the cultural groups, each group performed better in the visual condition.

Stimulus Equivalence and Familiarity

A great deal of discussion in the claims and counterclaims about culture-cognitive development hypotheses centers on *the* central methodological requirement for valid process inferences in cross-cultural research—subjects must be doing the *same*

task if comparisons are to be considered valid (Berry, 1969; several chapters in Triandis & Lambert, 1980). Curiously, this methodological knot shifts status when one takes a context-specific view of learning, as Serpell's study illustrates. From a "central processor" point of view, the fact that one cultural group may have more experience with a particular stimulus configuration than another is a nuisance. It has to be made to go away so that a "clean" comparison can be made. From a context-specific point of view, a stimulus familiarity "control" group is an important source of evidence for the notion that learning is different, depending on precisely how the culture organizes practice with any given stimulus configuration. Exactly those aspects of context for which methodologists keep seeking equivalents represent the description of culturally organized practice. With respect to stimulus equivalence, the folklore of psychological methodologies clearly indicates an area where everyone agrees: culture-specific knowledge controls differences in performance. It is also agreed that these *differences in knowledge can masquerade as differences in process*.

Despite extensive discussions on this topic, there has been no agreed-upon technique for ensuring stimulus equivalence in cross-cultural work or more broadly, comparative cognitive research. In the face of this difficulty, experimental psychologists have usually resorted to intuitive specifications of which tasks are familiar to which groups, and then attempted to produce cross-over effects. That is, they want to demonstrate familiarity effects by showing that people in Culture A perform better on Stimulus A than Stimulus B, while people in Culture B perform better on Stimulus B than Stimulus A. Serpell's study of Zambian and British representation abilities provides an excellent example of a cross-over study. It also demonstrates clearly the tight connection between the "methods" of seeking stimulus equivalence and the theoretical claims of context-specific research. The remaining examples in this section will pursue the implications of differential cultural exposure to relatively specific cognitive demands. Not all such studies are as elegant as Serpell's where a true cross-over was both predicted and obtained. But each provides evidence relevant to the general thrust of context-specific studies of culture and cognitive development.

Classification

A clear example of a cross-over effect can be seen in the research of Irwin, Schafer, and Feiden (1974), who were skeptical of claims that un-schooled Liberians (Mano) generally lack the ability to classify because they perform poorly when sorting geometric shapes. Examination of Mano cultural practices established that sorting rice is central to Mano economic activity. Rice variations are talked about in everyday discourse. Distinct variations of rice can be used as the logical equivalent of distinct variations in geometric shapes. Two sets of tasks, one using bowls of rice and the other using geometric shapes, were presented to Liberian-unschooled and U.S.-schooled subjects. Subjects had to categorize and, if possible, reclassify each set along three dimensions. These Liberian subjects, as past research indicated, had greater difficulty sorting geometric shapes than Americans, for whom this is typically a trivial task by the time a child is 10 to 12 years of age. But when the material to be sorted was changed to rice, the results were reversed. The African subjects were able to sort the rice, shifting dimensions and accounting for their sorts as skillfully as the U.S. sample had when the task involved geometric shapes. When U.S. subjects were faced with sorting bowls of rice, they demonstrated hesitation and bewilderment like that of the African farmers when faced with geometric shapes.

Fjellman (1971), working with Kamba children in Kenya, studied the relationship between familiarity of materials to be used in a categorization study and the attributes of the stimuli used to form the categories. She was particularly concerned to evaluate generalizations such as the following, based primarily on the application of psychometric tests: "The African way of thinking appears to be a predominantly concrete type, while that of the European white is of a more abstract nature" (Cryns, 1962, pp. 298–299).

Fjellman chose to assess these ideas by using a genre of classification task that had been used widely in the neurological and developmental literature, and for which there was also cross-cultural data. Subjects are presented a set of pictures or objects that can be grouped according to local categories in terms of such dimensions as their color, their shape, their function, or their common membership in some part of a larger conceptual scheme.

Using geometric shapes, several researchers had shown an influence of schooling on category choice (Greenfield, 1966; Serpell, 1969). Children who attend school choose to categorize by form earlier and more readily than those who do not. This finding seemed to mimic developmental increases in form choice and neurological evidence that brain-damaged patients revert to "concrete" attributes like color.

Fjellman was suspicious of these parallels. She noted Price-Williams's (1962) finding that Tiv children (both schooled and unschooled) formed taxonomic categories and did *not* generally rely on color when asked to classify and reclassify *objects common to their everyday experience*. Color as an attribute cropped up when stuffed animals were used as surrogates for the real thing. However, Price-Williams failed to use any of the geometric-form stimuli with which previous schooling effects had been established.

Fjellman remedied this shortcoming by her work with Kamba children who lived in urban or rural settings and who did or did not attend school. Consistent with several other results, Fjellman found that schooling enhanced categorization by form, the more "abstract" attribute. But when 17 pictures of animals known to all the children were used, the judgments of the urban schooled children were markedly more "childish" (according to standard criteria based on the category justifications used) than reasons given by any but the very youngest rural, unschooled children.

In presenting these results, Fjellman makes a very important point about familiarity:

> The animals pictured were equally familiar to urban [as to rural] children as measured by ability to identify pictures, but first-hand knowledge which comes from observation of their habits and patterns (particularly for domestic animals) and knowledge of the Kamba system of classification was not. (Fjellman, 1971, p. 104)

Fjellman went on to present other classification tasks involving different objects and different categorizing requirements. Under some conditions there were no differences discernible between groups: cooking and farming implements *whose functions were known to all* elicited a uniformly high level of functional categorizing. When another test was constructed with unknown cooking and farming items, rural boys relied on color rather than functional criteria.

Fjellman's results (only some of which have been summarized here) demonstrate the great care that must be taken to embody problems in materials and procedures whose "fit" with indigenous experience is made a part of the research design. It makes the corollary point, central to this immediate discussion, that because schooling, *by definition*, provides pupils familiarity with new aspects of the world, reliance on experiments whose procedures are examples of *school-based contexts* for problem solving

may err by mistaking differences in stimulus familiarity for deep or general cognitive transformations.

Studies of schooling's putative intellectual consequences have also helped to force closer examination of the different aspects of stimulus familiarity as possible points of contact between schooling and everyday (culturally organized) experience. Each of the studies reviewed thus far suggests strongly that stimulus familiarity cannot be reduced to "frequency encountering stimulus X." Rather, the nature of and variety of interactions with stimuli seem to be important aspects of stimulus familiarity as well.

This point is made forcefully in cases where simple substitution of one set of physical stimuli for another brings about *no* modifications in behavior. Thus, for example, Sharp, Cole, and Lave (1979) conducted a study in which categorization of geometric figures and maize were compared for educated and noneducated children. Consistent with Fjellman's results, classification improved dramatically as a function of years of education. But unlike Fjellman (or Irwin et al., 1974) there was *no* effect of switching to indigenous materials: maize that was red or yellow, large or small, and made up of single or double kernels. Only six out of 32 Mayan adults were able to produce a categorical sorting of the maize; three had sorted the geometric shapes.

This failure to classify in an experimental task cannot be attributed simply to unfamiliarity with the objects or the general inappropriateness of using the classes embodied in the experiment. Varieties, sizes, and configurations of kernels (single and double kernels) were offered by local people in their descriptions of the properties of corn grown in the area. But the task of dividing eight kernels of corn according to three different descriptive criteria for no purpose other than "to see if you can do it" was certainly an unfamiliar task for those who had not been to school. Similar difficulties were encountered by Greenfield (1974), Scribner and Cole (1981), and Gay and Cole (1967).

The role of different kinds of interactions with a "common" stimulus in controlling different aspects of stimulus familiarity is nicely summarized by Childs and Greenfield (1982). Their study concentrated on classification and representation of patterns used in weaving traditional male and female garments in Chiapis, Mexico. Boys (who do not weave) and girls (who do weave) were compared in the way they differentiate patterns. In experimental pattern-representation tasks modeled on weaving, the girls used thin white strips to distinguish patterns as they did when weaving; boys mixed pinks and oranges to get the desired effect as seen from a distance, ignor-

ing the fine-grained structure that produced the effect for the girls who viewed the patterns "with their fingers."

Childs and Greenfield summarize the differences in "stimulus familiarity" that these very prevalent garments represent to boys and girls.

> The girls' attention to the structural detail of the patterns contrasts with the boys' representation of a difference in superficial appearance, a difference nonetheless important in making the distinction between male and female Zinacanteco clothing. The role requirements of a Zinacanteco woman in relation to clothing are different. Girls need to know and use the detailed aspects of the patterns more than boys and so are more apt to choose those aspects when representing them. (Childs & Greenfield, 1982, p. 13)

From this careful description of precise relations to weaving and its products, we can see that although the patterns used in this "pattern-representation test" seem equally familiar to all Zinacantecos, they are not equally familiar in ways crucial to the interpretation of performance. In fact, the very activities that are the source of unequal stimulus familiarity are the source of the differential cognitive consequences.

Memory

The importance of what one is asked to do with familiar materials is posed dramatically in a series of studies by Scribner and Cole (1981, chap. 14). The topic in this case was remembering, in particular, remembering lists of words or pictured objects. The subjects were Vai (Liberian) youngsters and adults who had, or had not, undergone Muslim religious training that requires committing to memory long passages (ideally, all) of the Koran. Scribner and Cole hypothesized that practice in decoding Arabic characters (the Vai do not speak Arabic) and remembering verses should enhance list learning of analogous types. The key problem was to specify a proper analogy. Preliminary study indicated that when given a free recall test where word order in recall is irrelevant, Koranic scholars are no different than the rest of the population. Some indications of superior performance by Koranic scholars appeared when subjects are required to learn words in strict serial order. But a clear superiority appeared only when words or objects are presented in a systematically cumulating fashion that models closely a major teaching technique associated with Koranic recitation. As the familiarity of the *operations* increased, performance increased selectively and accordingly.

In a test of culture-specific remembering tasks that hypothesized nonliterate superiority, Kearins (1980) designed a series of experiments to investigate the relationship of environmental pressures to remembering skills. The Aboriginal inhabitants of the western desert region of Australia, like many other nonindustrial societies, have been shown to perform poorly on a number of standard psychology tests (Dasen, 1972; deLemos, 1969; McElwain & Kearney, 1973). These estimates of intellectual ability contrast with a long history of successful adaptation in a desert region that recent European settlers find to be uninhabitable. Kearins reasoned that requirements of survival in such an environment might result in the development of the ability to attend to small changes in spatial relationships and subsequently to recall the proper locations.

Kearins compared spatial memory skills of Aboriginal Australian children with Anglo-Australian children. The children were shown a number of items arranged in matrices of different sizes for 30 sec. After a few seconds, they were asked to replace the items in the order in which they had been seen. She controlled for object familiarity by using two different types of materials: "natural" objects (stone, leaves, stick, etc.) and "artifactual" objects (bottle, knife, matchbook). To test for difference in the use of verbal and visual strategies, some displays were made up of objects from the same lexical category (i.e., rocks) varying in size and shape while other displays were made up of objects each from a different lexical category.

The Aboriginal children were consistently better able to reproduce the display regardless of the size of the matrix, the type of materials used, or the degree of similarity among the objects. The Anglo-Australian children's best performance was on the artifactual display in which the objects all came from different lexical categories, but even on this task their score was significantly lower than that of the Aboriginal group.

There were clear behavioral differences in the way each group approached and worked on the problem. Aboriginal children viewed the display in silence and, after stabilizing their position, sat motionless during the 30-sec observation period. When replacing the items, they tended to work at a constant rate, usually holding an item above a location before placing it and rarely moving objects after they had been placed. When asked how they remembered the display, their most frequent response was that they remembered the "look" of it. The Anglo-Australian children were more likely to move around the display, pick up, and point to objects and could be heard whispering, muttering, or naming objects.

They moved about restlessly while waiting to replace the items and then generally replaced four or five immediately, with the rest of the items replaced at a much slower rate. These children were also more likely to move objects around after they had been placed. Their accounts of their remembering suggest the use of verbal strategies: "I tried to learn around the outside by saying the colors of the bottles" or "I remembered what was in it, the shape, the color . . . I described them to myself."

A memory task performed by Mayan and U.S. 9-year-olds in a study by Rogoff and Waddell (1980) displays related phenomena. When the work of remembering 20 items was embedded in the reconstruction of a contextually organized three-dimensional scene, the memory test performance decrement that had previously been noted for Mayan children disappeared; in fact, the Mayan children's performance appears to have been slightly better than the U.S. children's. Rogoff and Waddell (1980) point to the "ubiquity of having to remember things in everyday life using the contextual organization of the material as a recall aide." They contrast the way their memory task mirrors this everyday situation with the way other memory research puts a premium on memory for isolated bits of information for which external, noncontextual recall aids must be supplied by the subject or by training procedures. The U.S. children appeared to use rehearsal strategies while the Mayan children appeared to use spatial organization and a more relaxed discussion criteria. The important result is not a cross-over effect but the disappearance of an advantage as a more everyday memory task renders impotent the strategies that provide the advantage to U.S. children in other kinds of memory tasks. Both cultures provide for context-specific practice in the Rogoff and Waddell task; a memory deficit of Mayan children does not occur.

Communication

An example in which stimulus familiarity (rather than task familiarity) is usefully reinterpreted in terms of context specificity comes from the work of Lantz (1979). Lantz sought to evaluate the suggestion of Bruner, Olver, and Greenfield (1966) that rural unschooled children may lack symbolic representational skills because their linguistic ability is tied to the immediate context of the referent. Formal education, they said, facilitates the development of language into a fully symbolic tool that can be used for communicating about things in their absence and for mediating other cognitive processes such as classification and memory (Bruner et al., 1966).

Lantz designed a study that would distinguish between the *absence* of symbolic representational skills and the *variable manifestation* of these skills in different contexts. She selected a coding task that would measure communicative accuracy as well as assess classificatory skills and memory. Children were shown an array of objects and asked to describe each item so that it could be distinguished from the others. Sometimes they were told that they were describing stimuli for themselves (Condition 1) or for another child (Condition 2) at a later time. The subjects in this study were rural, unschooled and schooled Indian children, and schooled U.S. children at three different ages. Two different stimulus arrays were used: a color chip array and a grain-and-seed array.

Lantz reasoned that although the Indian children have a complex color terminology, colors in their culture are frequently substituted for one another with no functional consequence. Grains, on the other hand, are an extremely important part of the village life. Communication about them is important in many contexts. Just the opposite relation between stimulus familiarity and culture was hypothesized for the Americans (on grounds that are not particularly well motivated).

As predicted from a context-specific learning hypothesis, the rural unschooled children coded and decoded the grain-and-seed array with no difficulty; they performed higher than either the schooled groups, Indian or American, at all ages. The schooled Indian children also scored significantly higher than the schooled U.S. children. This finding clearly shows that children from a nontechnical society without the benefit of formal schooling are able to separate language symbols from the physical referent and to use those symbols for communicating accurately in an artificial situation.

But display of the ability depends upon the stimuli used. A very different pattern of relative abilities emerges for the results using the color array. The U.S. children scored significantly higher than both Indian groups. The unschooled Indian children did especially poorly on this task. They were unable to decode even their own labels let alone those produced by other children. The schooled Indian children, when given their own labels to decode, did show higher performance, suggesting that they were able to extract some useful information from the codes they conjured up. But their performance was poor relative to the U.S. sample.

Apparently Lantz's guess that the two classes of stimuli would function symmetrically and oppositely in the two cultural groups was too simple because the specification of "culture" as it relates to the arrays used in this study is unclear. The color stimuli may not be embedded in exchanges requiring

communications as are dimensions of grain in *either* culture. The subject must then really invent item and category markers in the color task. This facet of intellectual activity, inventing and using thought-structuring "schemata" has consistently been found to be a consequence of modern schooling, an institution whose characteristic activities appear very similar in a variety of cultural settings (Jahoda, 1980; Rogoff, 1981; Scribner & Cole, 1973).

The Cognitive Consequences of Literacy

Research on the consequences of literacy based on historical and ethnographic data had suggested very general cognitive consequences of learning to read and write: changes in the nature of deliberate remembering (Havelock, 1978), logical reasoning (Goody & Watt, 1963/1968), and uses of language in a variety of settings (Olson, 1977). (See also, McLuhan, 1962; Vygotsky, 1962.)

Some experimental work aimed at testing these ideas was carried out in the 1960s and early 1970s. But this research all rested on comparisons involving *schooling* (e.g., Greenfield, 1966, 1972). Although reading and writing are clearly central to schooling as we know it, there are many reasons for expecting that practice at learning and reproducing large amounts of novel information organized around modern scientific and social concepts—not the ability to read or write, per se—is the basis for widely reported differences between schooled and unschooled populations on relevant cognitive tasks.

Scribner and Cole (1981) carried out their research among the Vai of Liberia, a culture that provided an unusual opportunity to disentangle literacy from schooling. The Vai are remarkable in that, although their culture is in many respects indistinguishable from the slash-and-burn agricultural groups that live around them, they use not one, but four distinctive systems for writing. Each system is associated with different spheres of activity: literacy in Vai for conducting family and community business; literacy in English for dealing with the government, schools, and modern economic institutions under the control of English speaking Liberians; literacy in Arabic for two purposes—one religious (reading the Koran), the other recordkeeping.

Scribner and Cole conducted several series of studies with these four groups (English, Vai, Arabic, and Koranic literates) to determine the nature and generality of cognitive skills generated by each kind of literate practice. In their initial investigations, they selected a variety of classification, mem-

ory, and logical-reasoning tasks that had produced improved performance for *schooled* literates in previous research (Rogoff, 1981; Sharp, Cole, & Lave, 1979). English schooling produced changes in many, but not all, of the tasks, while the other literacies produced almost none. The most consistent effect of schooling was to improve individuals' abilities to explain the basis of performance on cognitive tasks.

Finding no measurable consequences of Vai literacy, Scribner and Cole then narrowed their focus. They designed a new series of tests to demonstrate *metalinguistic* consequences of becoming literate. Very little evidence for effects of any of the literacies encountered in Vai country were found in this phase of the work. The strongest result to emerge was increased skill on the part of schooled and Vai literates when asked to explain the basis for judgments of grammaticality.

The combined results of these two lines of study discouraged the notion that literacy, per se, produces the general cognitive changes previously associated with schooling. Indeed, while schooling produced changes in performance on many tasks, its effects were by no means uniform.

At this point, Scribner and Cole tested very specific hypotheses about cognitive effects growing directly out of analyses of literate practices. From analyses of a large corpus of letters, they hypothesized that Vai literates ought to be able to communicate more effectively with someone in a remote place. Since writing letters requires practice in formulating descriptions for someone who does not share one's knowledge of the events to be described, Vai literates ought to produce fuller, less egocentric, descriptions. The researchers constructed rebus-like tasks, which required people to code and decode simple graphic symbols that could form propositions. To differentiate among the various literate groups (all of which engage in such activities in order to read or write), Scribner and Cole constructed one task based on syllables (the units of analysis central to Vai script, but only implicit in Arabic or English) and another based on words as the basic units.

The outcome of these studies yielded clearcut evidence of *function-specific* cognitive change, where functions were implemented within different, but overlapping contexts of cultural practice. The two literacies used widely for letter writing, Vai and English, both improved performance on the communication task. All the literacies where understanding the text was important improved performance on the

rebus tasks. However, only Vai literacy produced improved performance when the basic graphic units referred to *syllables*.

Context and Practice

Following Scribner and Cole, we wish to interpret these results within a context-specific theory that specifies the within-context structures of activity. In those cases where an outcome does appear to be directly related to reading and writing, the analysis of the social organization and purposes of writing points at literacy-related *practice* as the crucial experience. Thus, the increased ability to explain the basis for one's cognitive performance is attributed to modes of classroom discourse in the case of the schooled students, for whom questions such as "How did you know that?" "What makes you say that?" "Go to the board and show us how you do that" are a routine accompaniment to becoming literate. The improved ability of the Vai literates on the communication task has a straightforward interpretation based on the structure of Vai literacy practices. Their ability to explain the basis of grammatical judgments (but not other cognitive judgments) is again attributed to their custom of discussing the properties of proper Vai speech, occasioned by letters containing unusual constructions. Finally, although the evidence that both English schooling and Koranic-Arabic literacy improve performance on memory tasks is weak and spotty, this evidence is consistent with the fact that these two literacies—but not Vai—require practice in remembering large amounts of novel material, material that is often devoid of specific meaning to the rememberer.

Shortcomings of a Context-Specific Approach

In many cases where generalized cognitive deficits are assumed on the basis of test results modeled on laboratory tasks or psychometric tests (which, we have argued, are historically linked), manipulations of the conditions of the testing, or of the stimulus materials modify performance so that under some restricted set of conditions, a presumably absent ability makes its appearance (as in Cole et al., 1971; Scribner & Cole, 1981). One of the general strategies that has been used by researchers who focus on this situational variability is to take the performance deficit as a point of departure. They seek to explore people's performance on tasks that occur naturally in the culture and that then serve as models for experimental tasks. The goal of such research is to discover indigenously organized samples of the intellectual behaviors that the experimenter's original task was designed to sample, and then to return to controlled environments in order to "locate" the experimental task with respect to its indigenous variations (Cole, 1975; Scribner, 1975).

Examination of published examples of such work indicates that this approach remains programmatic. Not the least difficulty confronting researchers who have adopted this strategy is that of finding, in everyday life, those enactments of tasks that predominate in experiments (Cole, Hood, & McDermott, 1978).

This work has not been without its successes. In several cases, plausibly analogous indigenous activities have been discovered and used as the basis for further experimentation. But with few exceptions (to be discussed further in a later section) such work has stopped far short of providing a complete map of the domain of inquiry let alone a comprehensive picture of the ways that cultures use to organize the specific contexts where skills are displayed (e.g., see Childs & Greenfield, 1982; Cole et al., 1971; Greenfield, 1974; Lancy, 1977; Scribner, 1977; Super & Harkness, 1980).

In some cases a performance deficit has been manipulated experimentally, without discovering the cause of the specific performance deficit that initiated the research. When this impasse has been reached, the ethnographic literature is searched for plausible reasons for the experimental results. Referring to an example involving a referential communication task, Jahoda nicely captures the limitations of a good deal of context-specific cross-cultural work.

> Cole set out to track down the causes of this poor performance in some detail. (Kpelle farmers had failed to communicate sufficient discriminating attributes of to-be-identified objects.) Some of the empirical work was in fact undertaken, but most of his [*sic*] account consists of listing various possibilities like a seemingly endless trail vanishing at the distant horizon. (Jahoda, 1980, p. 124)

Later, after reviewing suggestions for how to view context-specific effects in a cultural context, Jahoda adds:

> [This approach] appears to require extremely exhaustive, and in practice almost endless explorations of quite specific pieces of behavior, with no

guarantee of a decisive outcome. *This might not be necessary if there were a workable "theory of situations" at our disposal, but as Cole admits, there is none. What is lacking in [the context-specific] approach are global theoretical constructs relating to cognitive processes of the kind Piaget provides, and which save the researcher from becoming submerged in a mass of unmanageable material.* (Jahoda, 1980, p. 126; emphasis added)

The italicized remarks bring us full circle to the issues with which we began. A theory of the relations between culture and mind must include a theory of both phenomena—culture *and* mind—in order to be a theory of their *inter*relationship. And, this theory must be accompanied by a theory of situations in which the interrelationships of mind and culture are enacted. In our opening section, we pointed out that during the nineteenth century culture and mind were viewed as different aspects of the same ordered phenomena. Jahoda counterposes culture ("a theory of situations") and mind ("theoretical constructs relating to cognitive process") as if a theory of culture and cognition could do without one or the other. It cannot, even when the structure of one's language appears to make such a separation inevitable.

The three broad approaches for studying relations between culture and cognitive development reviewed in this chapter should be seen as three guesses about the size of the social unit that will correspond to a given level of "globalness" concerning statements about mind. Piaget's basic guess was that the fundamental environmental predicaments embodied in concrete operational tasks would be universal in all cultures; Witkin and Berry (1975), without denying that possibility, emphasized within-culture universals of environment/child interactions, resulting in global "styles" of adaptation.

In both cases, a failure of behavior to cohere in uniform stages or styles wreaks havoc with the theories. Because generality is the "taken-for-granted-incorrigible-proposition" of these theories, specific variability is the demon they have to cope with, which they do by positing secondary mechanisms to accommodate the inevitable anomalies into the general theory.

The context-specific approach is strongest where the other approaches are weakest. Our specification of cognitive activities in test and experimental situations is as strong as the concurrent theory of behavior in those tasks will allow. The examples in this section demonstrate that there has been some headway

in converting the process of "locating the experiment" from the stage of demonstration to the stage of theory. However, as Jahoda quite correctly points out, there has been no principled way to escape the "endless trail" of particulars.

It strikes us as significant that Jahoda's criticism of the context-specific approach coincides so neatly with Harris' (1968) complaints about Boas' "historical particulars" or White's (1949) concern that Boas had doomed American anthropology to atheoretical detail-mongering. As thoughtful commentators have noted (e.g., Bock, 1980; Stocking, 1968), Boas never rejected the goal of a general theory of mankind built out of the elements of ethnography; but he became badly mired in pursuing evidence of the diffusion of culture elements in the hope that eventually, if not during his lifetime, the material that he and others retrieved would come together to reveal the organization of the grand mosaic.

But Boas's failure to build his critique of nineteenth-century anthropology into a new synthesis did not mean that the critique could be ignored. Twentieth-century anthropology has not yet succeeded where Boas failed; instead, it has mapped with great sophistication the various cul de sacs and promising pathways of the common problems facing all who enter the discussion.

The situation is not far different in contemporary studies of culture and cognition. What we need is a theory that can provide theoretical guidance to allow separation of general laws from the infinite variety of specifics that flood the fieldworker—psychologist and anthropologist alike—who ventures into another culture. But that theory has to be built on as solid a factual and logical foundation as current knowledge will allow.

In the sections that follow, we will reexamine the problem of cultural influences on cognition in the manner suggested by Jahoda's contrast between a "theory of situations" and a "theory of global processes." The central question organizing this discussion will be: How does behavior that is initially context bound and particular become, or appear to become, behavior embodying general characteristics of mind?

FROM THE SPECIFIC TO THE GENERAL

The between-cultural universal, the within-cultural universal, and the context-specific approaches compared and contrasted in the previous sections can be usefully summarized by reference to Figures 2 and 3. Figure 2 represents what we refer to as a *central-processor approach* found in the two univer-
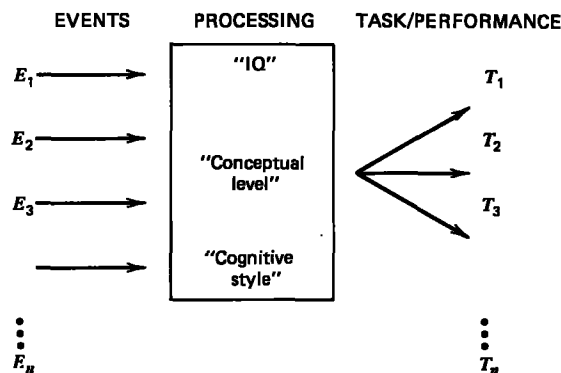
EVENTS   PROCESSING   TASK/PERFORMANCE

Figure 2.

salistic theories. The central-processor approach assumes that experiences operate on the current state of some central cognitive machinery, which in turn guides performance on the range of tasks that individuals encounter. The domain of the processor and its hypothetical structure are different for different theories. For Piaget, the processor corresponds to a universal set of elementary facts about *Homo sapiens* and their shared world. It is endowed with hierarchically organized structural units. For Witkin and Berry, the domains correspond to ecocultural niches, and the processor is structured in terms of hypothetical amounts of differentiation and integration.

Despite differences in terminology, data bases, and the internal structures they posit, both approaches assume that each learning experience $(E_1, E_2—E_n)$ potentially contributes to an increase in power (level, amount) to a central processor that is then deployed to deal with individual performance tasks $(T_1, T_2—T_n)$.

The achievements of these central-processor approaches have been considerable, and they may represent a useful, even correct, approach to the issues. But we think that outstanding sources of disagreement can best be minimized, if not eliminated, by taking a different tack, an extreme version of which is charactered schematically in Figure 3.

Like the central-processor approach, the contrasting "distributed-processor" approach sketched in Figure 3 links experiences (E_1) to task performance (T_1) through discrete schemata. However, a "distributed-processor" theory places little emphasis on processing that is common to all tasks. Instead, this approach treats cognitive processing as *distributed*. It is distributed in two senses; individual learning is assumed to be context-dependent in the first instance (e.g., distributed by situation), and

processing is *socially* distributed among people within contexts, in the second. This context-specific approach is strong where the central-processor theories are weak; it accounts for variability by specifying the diverging lines between culturally organized practice and task-specific performance. It also offers relatively specific models of culture-specific, task-specific cognitive processing. But the problem with this formulation, as we have noted, is its failure to account for the *generality* in human behavior. Skills and knowledge acquired in one setting often *do* appear in other settings under recognizably appropriate circumstances. In order for a distributed processing approach to work, it must provide some way to represent the fact that the individual events forming the base of the knowledge system are related to each other. The content and distribution of those events, that is, *their* organization, will be an important source of generality that we can ascribe to cognitive processes (e.g., that part of thinking controlled by the internal representations of external events).

In order to explain how generality could be, and is, achieved if learning and development are, in the first instance, context dependent, a theory must an-
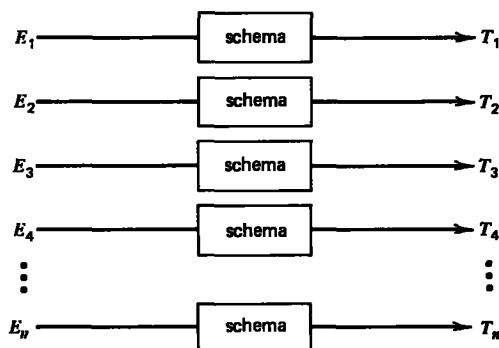

Figure 3.

swer several important questions. First, it must provide a way to describe the basic aspects of the events that constitute the fundamental contexts for activity in many culturally central domains of experience, and the basic unit of analysis in such an approach. Second, we need to understand cultural theories (belief systems) concerning how events are connected by members of any culture. At this point, we do not aspire to a general theory about the cultural constructions of reality. But some systematic ideas concerning what Lave (n.d.) has called "extensional domains descriptive of significant areas of experience" are crucial adjuncts to identifying fundamental events, for the structure of these domains will provide important hypotheses about *event linkages* and, thus, the *generality to be expected* from context-specific learning. Third, we need descriptions of the interactions among people which assemble behavior, indeed, the events that constitute their life experiences. Fourth, we need to consider ways that cultures might control exposure to events so that adult behaviors emerge over time in the behavior of children. The crucial question becomes: What conditions determine whether or not a child will encounter events of the kind necessary to produce change from one stage of generalizations to the next (understanding stage always to mean, "stage-within-context")?

Context Selection

According to the approach we are advocating, the kinds of contexts that children spend their time in are the fundamental units out of which cognitive development is constructed. Therefore, a central role of culture in producing cognitive differences will be context-selection mechanisms that operate on children as they grow up. A recent essay by B. B. Whiting (1980) provides one illustration of how such mechanisms might operate in ways that clearly link to a context-specific cognitive theory.

Previous work by Whiting had treated personality as a variable intervening between culture and individual behavior reflected in expressive and projective behavior. But, in recent years, she has begun to look at personality embodied in the everyday behavior of people and at the way that adults regulate access to important cultural contexts.

> We are interested in the contextual variables defined by culture that are associated with types of social behavior. . . . Our model is designed with the aim of facilitating cross-cultural research which purports to explore the regularities in the contextual components of social behavior. . . .

Our present theory does not deny that there may be some lasting effects of early experiences but dictates that we look as well to other experiences in the life course to explain social behavior. We do not deny the importance of the mother and father in molding the child but our analysis of samples of maternal behavior across cultures convinces us that *the mother and father's greatest effect is in the assignment of the child to settings that have important socializing influences.* (Whiting, 1980, pp. 96–97; emphasis added)

If one considers cognitive skills to be examples of social behavior (an easy allowance in that Whiting and her students have included cognitive tests in their work), it is clear that Whiting is suggesting precisely the kind of selection process that a context-specific theory needs, that is, a way to link contexts in terms of the cultural practices that sustain the group. Summarizing the results of the massive *Six Cultures* studies and more recent work on sex differences, Whiting characterizes the process linking contexts as follows:

> This theory says that patterns of interpersonal behavior are developed in the settings that one frequents and that the most important characteristics of the setting are the cast of characters who occupy the setting. . . . The settings one frequents are in turn related to the activities that occupy males and females of various ages in the normal course of living, activities that are determined by the economic pursuits and social structure and organization variables. (Whiting, 1980, p. 103)

The parameters of human life are described by Whiting in a way that is reminiscent of the ecocultural theory discussed above, and described at length elsewhere (Laboratory of Comparative Human Cognition, in press). But, there is a significant difference between Whiting's proposal and the standard psychological versions of the ecocultural approach. Instead of the ever-present molding of behavior by the accumulated contingencies of history and geography, we have a context-*selection* mechanism for developmental change.

> In the normal course of living, in as much as the settings one frequents change as one grows older and moves from childhood to adolescence to adulthood to old age, a person must be able to learn new behaviors especially if the changes in his/her life style involve interaction with differ-

ent categories of individuals or are in settings focused around new activities, settings with different standing rules of behavior.

Each setting is characterized by an activity in progress, a physically defined space, a characteristic group of people and norms of behavior— the blue print for propriety in the setting. Thus a child moving from the classroom to the playground interacts with adults and peers in different manners. The standing rules for these settings do not prescribe the same type of social interaction. (Whiting, 1980, pp. 103–104)

Many of the age changes that have been reported in the literature on child development may be the result of frequenting new settings as well as gaining new physical and cognitive skills. (Whiting, 1980, p. 111)

A context-selection approach of this sort is needed to begin to handle the problem of the apparent generality of cognitive processes. Whiting's work offers a promising beginning, but a great deal remains uncertain.

Missing almost entirely from Whiting's formulation of context selection and development is a description of the "interpretive procedures" (Cicourel, 1973) that are necessary to account for how people interpret rules in social situations, recognize the social circumstances they confront, and otherwise answer the question: "When is a context?" (Erickson & Schultz, 1977). In order to handle the massive comparative enterprise represented by her theory, Whiting and her colleagues made a series of strategic simplifications. Central was her decision to represent each interaction involving a child by coding what instigated the child's action and the child's response to this instigation. This coding required problematic judgments about people's intentions. All the evidence we have about the assembly of behaviors within the crucial contexts of enculturation indicates that they are complicated interactional events in which stimulus (instigation) and response are very difficult to disentangle (e.g., see Cole, Hood, & McDermott, 1978; Mehan & Griffin, 1980).

A second issue of doubtful status involves the mechanisms of transfer between one setting and the next. Whiting is quite straightforward on this point:

Our theory also hypothesizes that the habits of interpersonal behavior that one learns and practices in the most frequented settings may be overlearned and may generalize (transfer) to other

settings and to other statuses of individuals. These transferred patterns may or may not be appropriate to these new settings and can conceivably lead to maladaptive social behavior . . . . (Whiting, 1980, p. 103)

The mature individual must learn setting-specific patterns of behavior but his dyadic patterns are influenced by previous experience and habits. His/her perceptions of the responses of people in the new setting may be blinded by expectations carried over from the old frequented setting. (Whiting, 1980, p. 104)

What renders the status of these reasonable assertions doubtful is a great deal of evidence indicating that transfer between settings as complex as those considered by Whiting may be minimal or nonexistent (Shweder, 1979a,b, 1980). There is also a sizable literature in psychology indicating that even transfer between problem isomorphs is extremely limited or nonexistent when experimenters pose the problems, even when the problem solvers are college students (Gick & Holyoak, 1980).

Interaction Within Contexts

Contexts are not to be equated with the physical surroundings of settings—classrooms, churches, kitchens. They are constructed by the people present, in varying combinations of participants and audience (Erickson & Schultz, 1977). As McDermott and Roth (1978) have put it, contexts are constituted by what people are doing, as well as when and where they are doing it. That is, people in interaction serve as environments for each other.

We characterize activities such as those from which Whiting obtains her data as *cultural practices*, by which we mean activities for which the culture has normative expectations of the form, manner, and order of conducting repeated or customary actions requiring specified skills and knowledge (see Scribner & Cole, 1981). Cultural practices have to be learned as systems of activity. These settings have "standing rules," what cognitive psychologists term "scripts" (Schank & Ableson, 1977), anthropologists refer to as "contexts" (Frake, 1977), and sociologists call "background expectancies" (Cicourel, 1973; Garfinkel, 1967) that orient people to the behavior that is appropriate for a given situation.

A cultural-practice theory of culture and cognition resists the separation of individuals from the environments in which they live their daily lives.

This means that the relation between culture and cognition represents neither a purely subjective (in the head) nor purely objective (in the world) phenomenon; it is an intersubjective phenomenon, to be found in the interaction between people. Goodenough's notion that "culture consists of whatever one has to know or believe in order to operate in a manner acceptable to its members" (Goodenough, 1964, p. 36) provides a good start toward an interactional conception of culture and cognition. But this knowledge cannot be thought of in static or purely internal terms. Rather, as Geertz (1973, p. 44) suggests, the knowledge is akin to "a set of control mechanisms—plans, recipes, rules, instructions . . . for the governing of behavior." These mechanisms, embodied in cultural practices, are largely accomplished through the *co*operations of individual members of the culture in contexts of practical activity (Leont'ev, 1981).

People must display what they know *to* others and the meaningfulness of behavioral displays is established *by* the interpretation of others. Production and interpretation are mutually informing activities, conducted conjointly in interaction. Furthermore, the interpretation of a behavioral display in the present informs the production of behavior in the future, just as the production of present displays informs subsequent interpretations (G. H. Mead, 1934; Schutz, 1962; Voloshinov, 1973).

"Culture" and "cognition," then, refer jointly to behavior assembled by people in concert with each other. It is for this reason that a cultural practice theory takes cultural contexts, that is, socially assembled situations, not individual persons or abstract cultural dimensions as the unit of analysis for the study of culture/cognition.

Guided Change In Interaction

To our initial proposal that cognitive development is characterized by the mastery of context-specific knowledge about the world, we have now added the ideas that (1) cultures arrange the selection of contexts for children and that (2) one must study seriously the ways in which interactions among participants construct and maintain behavior in those contexts according to standing rules for the conduct of cultural practices. But we have not said much about how within-context interactions result in within-context mastery of essential cultural knowledge. In order to understand how the culture organizes for next steps of within-context development to occur, we turn our attention to the sociohistorical school of

Soviet psychology, which explicitly connects ideas of interaction with the concept of development.

The Relationship Between the Social and the Individual

The sociohistorical approach includes several proposals for how culturally organized social interactional patterns can influence the psychological development of the child. These proposals were made by Vygotsky and his followers in the process of developing a Marxist psychology (El'konin, 1972; Leont'ev, 1978; Luria, 1976; Vygotsky, 1978; Zaporozhets, 1980). A fundamental tenet of this approach is that human cognitive functioning emerges out of social interaction.[6]

The basic idea can be found in Vygotsky's "general law of cultural development."

> Any function in children's cultural development appears twice, or on two planes. First it appears on the social plane and then on the psychological plane. First it appears between people as an interpsychological category and then within the individual child as an intrapsychological category. This is equally true with regard to voluntary attention, logical memory, the formation of concepts and the development of volition. (Vygotsky, 1978, p. 57)

Vygotsky referred to the contexts organizing the social-to-psychological transformation of thinking as "zones of proximal development." Vygotsky defined this zone as the difference between a child's "actual developmental level as determined by independent problem solving" and the level of "potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, p. 86). He demonstrated the usefulness of the notion of the zone of proximal development when dealing with the issues involved in assessing mental ability.

For our present purposes, the most important application of the notion of the zone of proximal development may be seen in Vygotsky's analysis of instruction. In this connection he argued that children can benefit from interaction with more experienced members of their culture only if the level of interaction falls within a certain range specified by the zone of proximal development.

> Instruction is good only when it proceeds ahead of development, when it awakens and rouses to life those functions which are in the process of

maturing or in the zone of proximal development. It is in this way that instruction plays an extremely important role in development. (1956, p. 278)

From the sociohistorical viewpoint, a culture maximizes its impact on a child's development by providing regulative contexts that fall within the zone of proximal development. Of course, there are many ways that more experienced and mature members of a culture can influence the child's environment, but the following four seem particularly important.

First, culture arranges for the *occurrence or non-occurrence* of specific basic problem-solving environments embodied in cultural practices. Infants are taught to crawl or climb, sleep short or sleep long. Preschoolers learn to model in wire or draw (i.e., model with pen and paper). Students chant the Koran or read the Bible.

Second, the *frequency* of the basic practices is culturally organized. Does one read daily in class or weekly in church? When is it necessary to sort grains? How many times a day does one engage in pottery making and with how many products? Does one sell pottery as well as make it? Culture exerts an overwhelming power in answering such questions.

Third, culture shapes the *patterning* of co-occurrence of events. One may use an interrelated set of units to measure when selling and buying quantities of rice but measure cloth and tables with unrelated quantities. One culture provides for recall of spatial arrays using verbal rehearsal strategies and another without them. Written text is the vehicle for religious activity in some cultures, but not in others.

Fourth, cultures regulate the *level of difficulty* of the task within contexts. This regulation both increases the likelihood that potentially crucial learning events will occur and that costly failure will be averted. Arranging for babies to learn to sit erect by propping them in a hole with a blanket might be a starter task in one culture. Sewing buttons on a shirt may be the starter task toward becoming a master tailor in another. In each case, a series of difficulty levels leading to mastery is elaborated.

In summary, the sociohistorical approach to human cognition offers the following account of the relationship between culture and cognition. First, it proposes that there is indeed a strong connection between the social interactional processes that constitute activity in a culture and the psychological processes of its members. This is so because an individual's psychological functioning is seen to emerge

through the process of internalizing various processes involved in social interaction which is itself culturally organized. Second, the zone of proximal development provides the conceptual lynchpin in the process by which members of a culture, children and adults, produce the relationship between social and individual functioning. It is here that the social becomes individual and the individual becomes social.

An Example of Zone-of-Proximal-Development Analysis

An example from research on American children illustrates the way in which adults organize the learning environments of children, thereby creating effective zones of proximal development. Wertsch and his associates (Wertsch, 1978, 1979, in press-a, in press-b; Wertsch, McNamee, Budwig, & McLane, in press) have conducted a series of studies on how mothers help their young children carry out tasks such as assembling a simple puzzle in accordance with a model. The puzzle pieces were cut-out parts of a truck which 5-year-old children were supposed to insert into a frame so that the end product would be identical with the model. Each child was helped by his or her mother through two assemblies of the same puzzle.

The course of the interaction as "the child assembles the puzzle while the mother assists" usually went something like this. During the first try at making the puzzle, the child might insert the pieces in the puzzle, but there is no attempt to make the puzzle in accordance with the model. If the model is used at all, it is because the *mother* negotiates the dyad's activity so she can include the model in the overall strategy. For example, she may make decisions about which pieces are to be used by looking at the model herself, or she may instruct the child to look at the model even though he or she does not understand what role it plays in the task.

During this early stage the child understands only very simple directives by the mother. These directives (which may involve both verbal and nonverbal communicative behaviors) are simple in the sense that they involve minimal understanding of what the mother and experimenter see as the overall task. For example, a regulative utterance such as, "Put the red one here" (with the mother pointing to the correct location) can lead to the appropriate task behavior on the part of the child without his or her understanding the relationship between "the red one," the model, and the puzzle. As the task session progresses, the mother is often able to utilize more complex speech to elicit appropriate task behaviors from

the child. For example, she may use a regulative utterance such as, "Where does the red one go?" This utterance is more complex in the sense that, unlike the earlier one, it requires the child to identify and execute several substeps of the overall task in order to respond appropriately. Thus in order to identify where the red one goes the child must be capable of regulating her or his own activity to check the model.

Of course, this does not mean that whenever a mother uses a complex regulative utterance the child will respond appropriately. In those cases where an inappropriate response occurs, however, the mother is likely to follow up the child's response by switching to a simple directive that makes explicit the substeps implicit in the complex directive. For example, in the case of the complex directive we mentioned above, the mother might say, "Look over here [pointing to the model puzzle] and you can see where the red one goes." In this way, the child is given a demonstration of how to "unpack" complex regulative utterances in the task situation and of how to expand the context of the task and thus to move closer to the overall task definition shared by the mother and experimenter.

The range of semiotic options available to the mother makes it possible for her to provide assistance to the child at various levels. This is a crucial aspect of development since the zone of proximal development can be expected to change as the child's experience with the problem increases. Initially, orientation to the task, selection, comparison, and even motor components of the problem may in large measure be carried out by the mother, who elicits required motor and verbal compliance from the child. The mother is doing more than the child can do, but not so much more that the child cannot participate. As the child comes to take over more of the task, the mother shifts the nature of the work she does (e.g., offering praise or pointing to troubles a few steps ahead).

In a manner reciprocal to adult options, the child can participate in the task at several different levels. These include bare participation where an adult guides the child through the appropriate steps in the task when the child understands little more than that there is a task, or maybe even only that there are a series of small tasks that the child does not yet see as components of an overall task. By participating in interaction understood by the adult (the interpsychological functioning characteristic of the early stages of learning a task), a child can "accomplish" the task before the child understands what he or she is doing. Rather than understanding the task

first and then carrying it out, in this sequence of events the child carries out the task (on the interpsychological "plane") and then understands it. The child's understanding of the task and of the associated complex regulative speech of the adult is a consequence, rather than a prerequisite, of going through the task. (It is what Cazden, 1981, has aptly called "performance before competence.")

The interactive nature of the learning process is highlighted by two facts, so mundane that they invite inattention. First, one never sees the mother sitting next to the child, blithely putting the puzzle together. The child *is always* a participant, and that participation is made possible by the adult. The *nature* of the participation is interactively negotiated by child and adult. Second, the puzzle always gets put together. This puzzle problem is well within the independent problem-solving capacity of one of the participants, so, of course, it gets done. Putting these two facts together, we can see the basis for a claim that development always occurs in a zone of proximal development. Additionally, that zone is dynamically achieved by the *child and others in a social environment.* Initially, it may seem that for any problem the social environment may be doing more than its share of the work, but the achievements of the child/mother in interaction with each other (with the mother carrying a heavy cognitive load) are progressively transformed into achievements of the child, with the mother serving as a distant prop.

The central insight embodied in these ideas about the immediate contexts where development occurs is that crucial events causing change from one level to another heavily involve other people; and in the case of young children, it is generally older people who provide an environment that makes likely the necessary learning. In this sense, important aspects of cognitive development "come from the outside" in the form of socially organized information about the goals and constraints regulating behavior. In some cases, the child will quite literally be *told* the necessary information ("You better check the model before you choose a puzzle piece, silly!"); in others, adults only make the important factors salient ("Which piece will fit into the corner?"); and in still others, they may do no more than make it possible for the child to be present while potential learning events are in progress ("Come sit on my lap while I help your sister figure out this puzzle."). Directly or indirectly, the social environment is likely to be providing important information to sustain and increase the efficiency of thinking. This is not to imply that children have no role in structuring the environ-

ments that in turn structure their behavior. As our example from Wertsch's work indicates, the child's behavior provides the adult with crucial information as well as the other way around.

The Zone of Proximal Development in Soviet Cross-cultural Studies

Sociohistorical psychologists never exploited the potential of the zone of proximal development as the locus of development in cross-cultural work. Only one cross-cultural expedition was undertaken at the time these ideas were being developed (described by Luria, 1976), and few have been taken since that time (Tulviste, 1979). Almost all of the scanty Soviet work sought to demonstrate qualitative shifts in the basic activities that underpin cognitive systems for preliterate and industrialized people. No research went into an exploration of how these different kinds of activity systems came into being and how they operate to reproduce themselves across generations.

In view of the fact that the sociocultural theory posits the zone of proximal development as the focus of learning and use of higher psychological functions, it may appear surprising that no work was put into comparative studies of concept acquisition. One can point out the limited attention given to cross-cultural work as an explanation for this neglect. But the failure runs deeper. A commitment to the sociohistorical approach applied cross-culturally is a commitment to looking at how cultures organize learning environments for their members, especially their young. Following his theory, Luria went to Uzbekistan to discover the cognitive consequences of the dramatic shift from traditional pastoralism to literate, technological activities. He conducted interviews and experiments to tap these consequences. But it is in interaction *between Uzbeks* not in interactions between Uzbeks and Russians that the theory predicted the operation and acquisition of Uzbek concepts and problem-solving modes. Nowhere in the world has the sociohistorical research program been carried out. However, a great deal of work has been done that illustrates hypothetical pieces of the overall process.

The Zone of Proximal Development in Anthropological Research

In a wide variety of studies, cultural anthropologists have described the patterns of family interactions called socialization or education "in the broad sense" (M. Mead, 1958; Raum, 1940; for a review, see Mead, 1958). Overwhelmingly, in pretechnological societies, whether of hunter-gatherers (Lee & DeVore, 1976) or agriculturalists or pastoralists (Whiting & Whiting, 1975), children are described as participants in a wide variety of social activities that we consider adult. Their role as participants varies as they grow older, but not the fact of their participation. The more detailed ethnographies of the socialization process show that children are routinely assigned tasks commensurate with their current abilities as elements in a larger task guided by their older siblings or adults. Just as developmental psychologists can point to stages of understanding corresponding to logically connected aspects of the environment, anthropologists have pointed out that the sequences of child acquisitions in naturally organized learning environments have a strong element of necessity imposed by environmental constraints. The idea that one must be able to walk before it is possible to run exemplifies this central fact about psychological development's dependence upon the constraints imposed by biological structure and environmental contingencies.

An example of a specialized skill engaged in by adults that is learned in specific contexts regulated by older children and adults is given in the work of Kulah (1973). Kulah studied the use of proverbs in the formal and informal rhetorical discussions of Kpelle (Liberian) elders. He was interested in the way that young Kpelle children come to learn the meaning of the proverbs. His investigation showed that in a very important sense, proverb content and interpretation are not taught; they are "arranged for" through the organization of linked activities. The arranging starts long before any child is expected to know or use proverbs.

All Kpelle children engage in a variety of verbal games including riddling and storytelling. One genre of this game requires teams of children to pose riddles to each other. The riddles consist of two parts roughly akin to a "question" and an "answer." Both questions and answers are part of the traditional lore of the group. They must be learned as pairs. The children line up in two rows and sequentially challenge each other with riddles. The team that answers the most riddles correctly is the winner.

The teams of children are age graded. Children of a wide span of ages (say, from 5 to 15 years) may play; the oldest on each team takes the first turn, then the next oldest, down to the youngest. In this way, even the youngest member of a team is important, and even the youngest is around to learn many new riddles.

This activity is related to adult proverb use in the following way. The question or answer half of the riddles that the children learn are key phrases that will appear in adult proverbs. It is as if the riddle

learning serves to teach children the "alphabet" along the way to learning to "read words." For example, a "question" might be something like "rolling stone" and the answer, "no moss."

Kulah's research shows that the potential meaning in combining "rolling stone" and "no moss" is not well understood by young children, even if they know a lot of riddle question/answer pairs. In a task designed to see if the children would group different riddles by the common meaning that the adult interpretation specifies, young children did not respond as if one riddle was related in any way to the other. But as the children grew older, they came more and more to approximate adult groupings of riddles according to their "message." By the time they are old enough to participate in the adult discussions where these proverbs are a rhetorical resource, they show the adult pattern of proverb interpretation. They are ready to learn how to use their now-organized alphabet in a new context, as a component in new, adult, tasks. The adult contexts, in turn, reorganize the "old skill" into a new activity.

While traditional societies such as that described by Kulah provide examples of age-graded activities such as the riddle game, the major educational contexts are unlikely to separate children and adults.

Fortes emphasizes the unity of the social sphere of adults and children among many traditional African peoples.

> As between adults and children . . . the social sphere is differentiated only in terms of relative capacity. All participate in the same culture, the same round of life, but in varying degrees, corresponding to the stage of physical and mental development. (Fortes, 1970, p. 18)

This observation is especially well borne out in recent studies of adults and children engaged in common activities that serve both as contexts for important economic pursuits and for socialization of the young into necessary adult cultural practices.

Lave (n.d.) has recently completed a detailed study of the process of becoming a tailor among Liberian tribal people living in the capital city of Monrovia. A typical tailor shop is peopled by men and boys ranging in age from 6 to 60 years. The range in tailoring expertise is as great as the range in age. Rank beginners and masters work side by side in generally crowded quarters. In this setting, immediate economic necessity and longer term economic security combine to organize the learning activity of apprentices. From their first day in the shop, apprentices have to make themselves useful and masters must begin the task of making them independently productive.

Because the masters cannot sacrifice productivity, a well-worked-out series of steps in the mature practice of tailoring (in this case, making trousers and suits) has evolved, beginning with elementary tasks such as sewing button holes and progressing through a series of tasks (cutting, measuring, sewing zippers) of increasing difficulty. From time to time, Lave observed direct instruction (e.g., when a master ripped out a badly sewn seam to show how it should be done). At other times, masters would arrange special lessons using scraps of cloth or paper to permit practice in cutting or sewing on the machine. However, for the most part instruction was arranged for by including the apprentice in elementary steps *as a part of the adult activity*. In these circumstances, apprentices participate in production of the adult product at the highest level possible because this level is maximally profitable for all concerned.

A crucial feature of such arrangement of this kind of learning environment that fits precisely the idea of a zone of proximal development is that *all* stages of the mature practice are a salient part of the learner's environment, regardless of what "level" in the process he is working at. Thus, the learner is gaining direct practice at one level while observing the skills necessary for later levels. As Lave and many others note, this kind of arrangement ensures progress with relatively few errors while providing constant motivation toward mastery.

Another description of a culture practice organized as a zone of proximal development for novices is provided by the Childs and Greenfield (1982) study of Zinacantieco weaving, referred to earlier. As a part of their research, Childs and Greenfield conducted a careful analysis of the role of social guidance in the mastery of weaving. The guidance was of two kinds. First, there was direct intervention by an adult at points where the learner was making, or was about to make, a mistake. At the beginning of any step in the weaving process (which Childs and Greenfield separate into six major steps), the adult was found to intervene heavily; toward the end of each step, there was little or no guidance. On the child's first garment, the adult spent 93% of the time weaving with the child. If a girl had completed one garment, adult participation was reduced to about 50% of the time. After as many as four successful garments, the adult was still involved directly in weaving about 40% of the time.

This guided instruction is by no means a silent process. Childs and Greenfield show that adult talk

is closely tied to the level of skill manifested by the learner and the specific circumstances that the child is facing. Commands dominate early in learning, and these are overwhelmingly of the sort "Do x." In later stages of learning, when the novice weaver's actions are less problematic, the adult talk shifts to statements that point out salient features of the present stage of the work or links between stages.

A second way in which adult Zinacanteco weavers guide practice is to provide children direct exposure to all of the steps of weaving and associated activities *as a part of the process of learning to carry out each of the steps*. We mentioned above that Childs and Greenfield assign six steps to the weaving process. From an early age, long before we might notice that they are learning to weave, girls witness the whole process with all of its six parts. To borrow another phrase from Fortes, "the child is from the beginning oriented towards the same reality as its parents and has the same physical and social material upon which to direct its cognitive and instructional endowment" (1970, p. 19). When it comes time to learn to weave the first garment, the process of applying what one has learned in the past to the circumstances at hand hardly arises.

A number of researchers in anthropology and psychology have focused on the mother/child interaction as the focus of developmentally significant learning experiences. In all cultures, the early life of the child presents child and family alike with a set of problems that are common to all of our species. But depending upon the complexity of environmental factors, the systems of socialization activities that deal with those common problems will be different. They must differ because passing on the culture to children is only a part of what must be done to maintain the species on a day-to-day and moment-to-moment basis. The organization of these other activities must modulate the organization of the child's immediate environment.

Kirk's work relating mother/child interaction to cognitive performance among Ga children illustrates cultural differences in the ways that mothers guide children's problem-solving efforts as a key mediator of improved performance. Kirk (1977) found that certain maternal behaviors correlated with greater skill on conservation tasks, while differences in subcultural groupings (rural, urban, suburban) did not so correlate. Her research shows that mothers who most frequently used specific referents to indicate relationships, and who justified and explained events, had children who performed on higher levels on conservation tasks. This parallels an earlier finding (Kirk & Burton, 1977) from Kenya, where the

nonverbal communicative specificity of mothers in teaching interactions was closely associated with the cognitive performance of children. In these studies, as well as those by Rogoff (1978), the terms used to describe the more effective maternal activities are the same terms we would use to describe environments that constitute effective zones of proximal development.

Connections Between Contexts

Thus far we have considered several important issues that have to be resolved in order to build a context-specific approach to culture and cognition into a theory that can encompass the major known phenomena: the ideas that ecocultural constraints operate through context selection, that contexts represent systems of activity, and that cognitive change is often interactionally managed within the significant contexts of socialization.

Still missing is an explicit statement of how a context-specific theory accounts for the ways in which past experience carries over from one context to the next. In both the Piagetian and psychological differentiation approaches, the mechanism invoked to provide for intersituational consistency is called *transfer*. But, as we will see, traditional invocations of this term will not solve the problem.

Current Psychological Evidence

A standard procedure for assessing transfer between different contexts in which the same behavioral principles are believed relevant is to train subjects to solve problems in one form and then to test the influence of this learning in the new, isomorphic problem context. For example, Reed, Ernst, and Banerji (1974) gave college students two isomorphic problems to solve. The first was the classical missionaries and cannibals problem, the second, a logically identical problem involving husbands and wives. The similarity of the task structures was *not sufficient to induce transfer* between the two problems. *Transfer occurred only when the subjects were explicitly told about the relationship between the two problems*. A similar finding is reported by Wason and Johnson-Laird (1972) concerning a logical problem presented in the form of abstract symbols (vowels and numbers) or in everyday language concerning postmasters, mail, and stamps.

A more recent study by Gick and Holyoak (1980) demonstrates just how difficult it may be to obtain transfer among problems that are extremely similar from the experimenters' point of view, and ex-

tremely similar for the subjects too, once they are told about the similarity. What makes the failure of transfer seem odd is that Gick and Holyoak went to a lot of trouble, short of giving verbal hints, to make certain that the relevant analogous information was known to the subjects. But availability of information was not sufficient to induce transfer, because subjects failed "spontaneously" to apply the known, relevant solution. Gick and Holyoak's summary of the obstacles to transfer in their study pinpoints precisely limitations on the amount of "spontaneous" transfer to be expected among the significant contexts of children's lives:

> A potential analogy may often be encoded in a very different context from that in which the [current] problem appears. Indeed, the basic problem in using an analogy between remote domains is to connect two bodies of information from disparate semantic contexts. More generally, successful transfer of learning generally involves overcoming contextual barriers. This may not be easy . . . . (Gick & Holyoak, 1980, p. 349.)

Thus, it appears from the recent psychological literature that transfer (as spontaneous application of analogies among remote contexts) is a weak theoretical reed to use as a central mechanism in any theory of culture and cognitive development.

The perplexity of this work on transfer, when combined with evidence that learning is based on within-context skill mastery, is that all aspects of the emerging theory point to the isolation of cognitive achievements. But our experience of the world does not appear as a mosaic of unconnected fragments. One possible way out of this conundrum is to conclude that the appearance of order is itself an illusion. This position, an extreme version of the "constitutive" perspective described above, is suggested by Shweder's wry comment that:

> The everyday mind accomplishes a very difficult task. It looks out at a behavioral world of complex, context-dependent interaction effects and unsubstantial intercorrelations among events, yet it perceives continuities, neat clusters, and simple regularities. (Shweder, 1980, p. 77)

Although it is certainly true that *Homo sapiens* is engaging in creating order out of disorder, and while it may be true that *Homo sapiens* is more a rationalizing than a rational species, no one, including Shweder, is denying that past experiences operate in the present to influence behavior. The problem is

that detecting an analogy between disparate contexts seems to be a relatively rare *individual* achievement. Valuable as they are, current psychological approaches to the problem of transfer are not likely to provide us the evidence we need to build a theory of culture and cognitive development.

Yet, it seems clear that people *do* use past experience to conduct present behavior; and in this sense, all behavior reflects the transfer of past learning. This is confirmed in the psychological literature on reasoning, particularly that which deals with the reasoning processes that occur in mundane settings. Several contemporary theories of thinking are compatible with the notion that a great deal of knowledge is context specific. According to such views, thinking consists largely of the retrieval of context-specific information that is appropriate for the task at hand. An early theory of this type was proposed by Bartlett (1958) who claimed that in everyday thinking (of the sort that one can sample on afternoon talk shows, dinnertime conversations, and faculty meetings) conclusions are reached (problems are solved) with little consideration of logical alternatives because "in popular thinking the end of the preferred argument sequence itself takes charge of the selection of particular items of evidence" (p. 175).

Furthermore, Bartlett tells us that in everyday life the generalities and conclusions that are put forth and the evidence that is selected are strongly *socially determined*. The generalities and conclusions are usually a part of common wisdom and the selected evidence is more than personal recall; it is "social knowledge, socially distributed" (Schutz, 1962), evidence known as well to others in the group who would be likely to use the same evidence in the same circumstances.

Our problem of relating past context-specific learnings to new or future contexts can be formulated, in the light of Bartlett's work, as a problem of *socially determined retrieval* in the new or future contexts of socially determinded structures and processes. Clearly, there is a possible next step here. One particular process that may be socially determined is the process by which analogies are retrieved. In fact, we suspect that analogy-retrieving processes may well be a form of a culturally elaborated tool for generalizing or transfer (Scribner & Cole, 1973). But, such analogy-retrieving processes arise *in* domains *in* cultures, and an understanding of their use would still require a framework like the culture-practice approach described below.

A Culture-Practice Approach to Transfer

Instead of searching for a central, general mechanism that exists in the head of individual persons as a

way to account for transfer, a cultural-practice orientation urges us to look to the organization of the environments in which interactions occur. Emphasizing the importance of social organizations does not dismiss the research on transfer-as-individual-activity. Rather, it emphasizes that in several important ways, *transfer is arranged by the social and cultural environment*. This shift of focus does not so much solve the transfer problem as it dissolves it.

As the work of Lave, of Childs and Greenfield, and of other anthropologists (e.g., Lee & Devore, 1976) strongly suggests, contexts are the "threads" from which are woven the fabric of a society's total adaptation to its circumstances. LeVine (1970) and the Whitings' work (Whiting & Whiting, 1975) contain the same idea cast in a different mold, as does the entire ecocultural movement. If the implications that we are drawing from the research reviewed here are correct, these approaches do not have to depend upon the notion of generalized transfer to accomplish their goals. Overlap in environments and the societal resources for pointing out areas of overlap are major ways in which past experience carries over from one context to another.

Lave emphasizes another point concerning sources of intercontext transfer which applies well to the Childs and Greenfield weaving case and, we believe, to a great deal of our everyday, culturally organized experience. In speaking about the arithmetic problems that tailors encounter, she says:

> Most of the arithmetic problems encountered in everyday life have been seen many times before. They are routine occurrences. This follows from the general routineness of our everyday lives. The tailors come to work six days a week, make trousers, shirts and hats, alongside the same people they have been sewing next to for months or years, for customers many of whom they have known for years. (Lave, 1979, p. 4)

Repetition and redundancy minimize the problem of transfer posed by new and unusual problems such as those that constitute the backbone of psychological research on problem solving.

The single most pervasive resource, and the one that is easily overlooked in a discussion concentrated on learning and problem solving, is language itself. We have already had occasion to note the routine and repeated nature of a great deal of our experience. This routineness and repeatedness is coded in the lexicon, reinforcing whatever analogy-supporting data there may be in the physical characteristics of routine events. Thus, two instances of "weaving a hammock," described with those words, may be

responded to as the same in part because of the conventional and known meanings of the words "weaving" and "hammock," whereas alternative descriptions might not evoke transfer of knowledge. Understanding of this point is a major motivating force behind Whorf's (1956) insistence on the importance of language as a molder of thought; language represents a distilled cultural theory of what goes with what in the world. Children master their culture's theory of the connections between contexts as they master their language. This fact is the basis for Stefflre's (1965) assertion that "an individual will behave toward an object or event in a manner that is similar to the way he behaves toward objects and events that he encodes in the same way" (p. 12).

The importance of language as a code for the sediment of past wisdom concerning the relatedness of elements of experience can be illustrated by reference to the Gick and Holyoak (1980) work on transfer between logically identical problems. Their college students could not transfer problem-solving solutions from one example of a problem to another because they did not apply the appropriate analogy. One problem was embedded in a story of a brain operation; the other involved a military dictator. As separate as these problems sound, audiences hearing a description of this work at a professional conference have no difficulty understanding and instantaneously applying the appropriate analogy. The difference between the lecture and experiment arises because, in describing the two problems, speakers or authors refer to the two problems as "radiation problems" as a part of their description. When language encodes the relevant relation between distinct contexts, the contexts are no longer distinct; *no transfer as an individual invention* is required. We suggest that this phenomenon is extremely widespread and accounts for a great deal of the way that cultures render past problem-solving solutions available for analysis of present problem contexts.

Language, which codes the culture's theory of what goes with what, is a universal resource organizing transfer. In addition, there are culturally elaborated tools for organizing and manipulating information that accomplish generality of cognitive skills. Perhaps the single most important cultural tool for associating contexts among which transfer might occur is literacy. Its history can be seen as a case of the movement from the context specific to the general. If Schmandt-Besserat's (1978) account of the earliest precursors of writing is correct, the earliest writing forms represented no more than tallies for a very circumscribed set of objects in the earliest agricultural settlements. They were devices for recording the number of animals or amount of grain in tiny,

protoagricultural settlements. While their contexts of use must be considered quite circumscribed, these tallying devices became standardized for linking information in one immediate context (the amount of grain in a wagon) and the information in another context (the total amount of grain in a shed, or the amount loaned to a neighbor). For something on the order of 6,000 years, these devices remained context specific; only increasing in kind very slightly. But with the advent of bronzeworking technology, improved agicultural techniques, and the rise of trade, a more powerful system of recordkeeping was required. There were many more contexts in which such tallies were needed. As the connections between people became looser because of increased community size, intercommunity trade, and division of labor, people came to inhabit very different contexts from each other, even within the same culture. The tokens proliferated, modes of representing them changed, and eventually an alphabetic system was formed, the system on which contemporary literate practices in American schools are based.

Even from this brief account, it should be clear that writing is not an all-or-none invention. We cannot simply say, "The Greeks invented the alphabet." As the record clearly shows (cf. Gelb, 1963), the alphabet was the end product of many centuries of context-specific adaptations to changing circumstances. Both the way in which literacy is a tool designed and implemented in specific contexts and the linkages it provides between situation have been illustrated in the research by Scribner, Cole, and their colleagues described earlier (Scribner & Cole, 1978, 1981).

Alphabetic literacy is a powerful tool for storing and transferring information across time and distance. It is a transfer-producing tool. But it is not a context-independent tool. Rather, it too is tied very closely to the contexts of activity that constitute adult practice (Cole & Griffin, 1980).

Summary

Throughout this section, we have taken pains to point out that the way in which past experiences carry over from one situation to another is conceived of differently in cultural-universalistic and in context-specific theories. The cultural-practice theory deemphasizes transfer as a central process occurring within the minds of individuals and emphasizes movement of information across contexts as a *social* accomplishment. The tuition of young children by adults, their direct intervention, especially when a mistake is about to be committed, and adults' practice of embedding learning in everyday experiences,

are some of the ways in which environments ar arranged for events to reoccur. In fact, the massiv redundancy and repetitiveness of learning situation minimizes the occurrence of new situations. In thos unusual circumstances when people are confrontin; new situations, the physical features of those en vironments, the social distribution of social knowl edge, and the presence of a number of cultural re sources, notably language and literacy, assist ii providing bridges between contexts.

RECAPITULATION AND SYNTHESIS

We began this review of culture and cognitive development with a story of nineteenth-century human sciences in search of the nature of human beings. Our initial contrast was between Tylor, Spencer, and Morgan, who adopted an evolutionary theory of human *Culture* (with a captial "C"), and Boas, who objected to the evidence these three thinkers presented for their evolutionary sequences. He sought the mystery of human nature in the specific, historically accumulated designs for living, and discovered *cultures*, which could not be ranked with respect to uniform scales of development. For the evolutionary theorists, the notion that primitives think like children was a simple lemma, following from their basic assumption. For Boas, the configurations of adult psychological achievements were as variable as the configurations of cultures.

If we turn to developmental and psychological theories applied to a wide variety of cultural settings, we see the same argument recapitulated in a different guise. Evolutionary theory is represented by the most celebrated developmental theorists of the twentieth century, Piaget, whose theory posits a universal series of stages that characterize the organism by qualitatively different psychological structures. And we have Witkin, whose ideas are in several respects similar to Spencer's; they identify differentiation as a core concept of development (see also Werner, 1948). These psychological theories are similar in their belief in the organismwide emphasis on differentiations and integrations as basic elements of development, implications of the psychological states they propose, and in their willingness to order behavior from lower to higher.

The ideas of Boas appear in modern psychological form as context-specific approaches. The research of the Laboratory of Comparative Human Cognition and a good deal of research in contemporary psychology run counter to universalistic theses in several ways (see Bem & Allen, 1974; Cantor & Mischel, 1979; Nisbett & Ross, 1980; Shweder,

1980; Zaporozhcts, 1980). Where Piaget and Witkin see uniform stages and levels of information processing, these scholars see context-specific behaviors and attribute less power to central processing mechanisms that control generalization from one setting to the next.

The parallels between competing theories of cultural differences at the end of the nineteenth century and competing approaches to cognitive development in the late twentieth century run deeper than a "specific" versus "general" dichotomy. As we have been at some pains to point out, all theories need to account for both the context specificity and the interconnectedness of human behavior. In the nineteenth century, evolutionary theorists invoked the idea of independent invention to account for similar institutions encountered in different cultures. "Spontaneous invention" is the nineteenth-century anthropologist's equivalent to the twentieth-century psychologist's mysterious process of "spontaneously discovering the analogy." Boas's critique of the idea of spontaneous invention of cultural institutions is repeated in modern psychological discussions of transfer, or generalization, across settings. When we suggested in the previous section that design of contexts and within-context resources, including social resources, account for a good deal of the continuity in the everyday world, we were suggesting that change "diffuses" from outside the unit of analysis. The major difference between our suggestion and Boas's is that we changed the unit of analysis from a "culture" in a geographical locale to "individuals within a culturally organized context."

In reviews such as this, where well-established points of view compete as explanations for a large domain of facts, differences among theories and the facts that are used to substantiate those theories gain easy prominence. But the large areas of agreement among competing approaches are as important as the issues in dispute.

Points of Agreement Among Rival Frameworks

The approaches to culture and cognition discussed in this chapter have existed, in one form or another, for about 100 years. We will not resolve their differences in a single essay. We can, however, review the course of the discussion in search of the areas of general agreement, insights that seem to have broad implications, and crucial points of disagreement. Until rival approaches can agree on what they disagree about, they cannot be of much mutual relevance to each other.

One major point of agreement is captured in the progression from universal to culture-specific to context-specific environments for development. None of the participants in this discussion believe that there is only one proper relationship of cognition to experience and experience to cognition. All approaches recognize the existence of constraints on individual development common to all human groups, of constraints specific to each group, and of constraints that are experienced only by some people some of the time and that vary within and between groups. A second point of agreement concerns the importance of the social and physical worlds as environments for development. All recognize the importance of social interaction for cognitive development. A third point of agreement is that data derived from psychological experimentation are a problematic base on which to construct a theory of culture and cognition. The cultural and social experiences of people, those experiences that comprise the patterns and routines of everyday life, have to be represented in the enterprise. A fourth point of agreement is that development must be understood with respect to the adaptive problems facing the growing child. Insofar as cultures differ in those adaptive demands, the configuration of age-related changes should differ from one culture to another. As Dasen and associates (1979) put it, "We find that an ecological orientation provides a value free context for the interpretation of [cognitive] differences as unique adaptation, rather than as differential developments" (p. 79).

These areas of agreement are substantial. They insure that all participants to the discussion value the same domain of phenomena and that these phenomena are drawn from a wide enough perspective to provide some prospects for a unified theory of culture and cognitive development.

Contrasting Analyses of a Single Activity

At this point, a concrete example may clarify the implications of adopting the various approaches. Consider an activity that has been the focus of several studies reviewed in this chapter—a child learning to make pots from clay. From a Piagetian point of view, pottery making is an opportunity for "operational exercise." It provides an environment in which the child can gain experience with material being transformed in a variety of ways relevant to discovering the basic laws of conservation. As a result of this exercise, the child is more likely to have available a higher-order operation to use when some new material in a new setting is encountered.

From a differentiation perspective, pottery mak-

ing is an activity that exposes the child to culture-wide constraints that control the kind of mental activity it is most adaptive to engage in. Pottery making is part of a cultural configuration in which very general constraints from the ecology shape the learning environment in which the child learns to pot. Other constraints derive from other parameters: Who gives the instructions? How much innovation is tolerated? Who is permitted to make pots? Whereas for the Piagetian, potting is a token of operational exercise in concrete operations, for the differentiation theorist, it is a token of an environment that promotes more or less reliance on physical objects or persons, and relies more (or less) on individual initiative or social pressure to guide the particulars of the craft.

According to a cultural-practice theory, potting is one of many culturally organized activities that make up the participants' repertoire of knowledge. It involves the exercise of many skills in transforming material. This exercise is embedded in a set of social relations and requires the mastery of culturally transmitted technologies. It is a context that must be mastered as a behavior setting (Barker, 1968). Behavior settings are not disjoint, but the connectedness of the behavior within them cannot be accounted for satisfactorily by listing all the knowledge structures or behavioral constraints common to all, as the Piagetian and differentiation theorists claim. Rather, one has to look to (1) the larger contexts of which they are a part, (2) the actual skills required and mastered in the settings, and (3) the way that potentially shared components of such setting-specific activities are actually linked by the participants. Context-specific retrieval rather than context-general inference and deduction are then given a major role in cognition and development.

For a cultural-practice theory, the craft of pottery making is *simultaneously* an abstract theoretical activity, implicating universal features of the world, an activity that reflects cultural constraints, and an activity that promotes individual skill and personal meaning. Because this activity simultaneously represents these different psychological "elements," we need a systematic method to capture its complexity. The study of the interactional enactment of this craft in its cultural context offers us this possibility. Simultaneously, it provides a unit that characterizes both culture and cognition.

Points of Disagreement and Uncertainty

Despite these broad areas of agreement, parochialism persists, controversy about basic facts.

abounds, and leading theorists diverge in their theoretical assertions about the nature of culture-specific cognitive demands as well as the cognitive consequences of dealing with them. The points of disagreement center on the units of analysis on which the competing theories are based and on underlying ideas about the nature of development. The approach we have been arguing for, as crudely contrasted in Figures 2 and 3, suggests that behavior is more situationally constrained and dependent on interaction for its construction and maintenance than central-processor theories would suggest. It characterizes development as more dependent on differences in the knowledge base, and it gives a larger role to contextually sensitive procedures than do the central-processor approaches.

Identifying Constraints

As our previous discussion should have made clear, discerning significant variation in the universal predicaments of human development is a concern of all the theoretical approaches to culture and cognitive development. However, more is involved in resolving differences between rival starting points than finding evidence for general or specific adaptations. All major frameworks assume that the patterns of behavior observed represent the organism's response to constraints. But they do not agree on how these constraints have to be identified by the researcher to provide empirical support for a theory. A crucial source of uncertainty in all these approaches is a well-worked-out theory of what *relevant* constraints are operating at a given time in any of the settings used to test a particular experience/cognition hypothesis. Gravity constrains all human behavior the world over. But gravity is not generally considered a relevant constraint in studies of culture and cognition. Socialization practices are a relevant constraint on young children, but they are not a constraint that is believed to guide children's behavior totally in all the settings they find themselves in.

Rather, all culture and cognition theories include at least implicit assumptions about the settings where crucial constraints are relevant and therefore potentially operative. It is *only* in such settings that the theories are relevant and testable. In this sense, central processor theories also require a theory of situations. So, for example, Witkin asserts that field-dependent people are not expected to rely on social cues *in general*. Rather,

under well-structured conditions field-dependent people do not differ from field-independent people in the use they make of external social refer-

ents. When the situation is ambiguous, on the other hand, field-dependent people will seek information from others in their efforts to structure the situation, which they are less able to do without aid. (Jahoda, 1980, p. 100)

Similarly, as Bovet (1974) points out, conservation of quantity does not automatically arise as a potential problem simply because water is being transferred from one container to another. Such transfer must occur under rather well-specified conditions; there must be containers of equal dimensions at one point in the procedure and of different dimensions in another. A "misleading cue" must be present or no test or practice of the conservation principle is possible.

The Interpenetration of the Social and Physical Environments

This issue is fundamental for reconciling different views of culture and cognitive development. Unfortunately, the theoretical assertions that social and physical environments are part of a single system acting on the child has not been matched by techniques that would build such an important assumption into the basic methods on which competing theories rest.

The interpenetration of social and physical experience goes well beyond recognition that there are other people, as well as objects, in the child's environment. As El'konin eloquently pointed out, even most objects cannot be considered asocial; the system "child/thing" is in reality the system "child/social object" because objects are themselves socially defined and shaped.

A major shortcoming of current ecocultural psychological differentiation theory with respect to the relation of social and physical environments is its distinction between "cognitive development" and "the development of social interaction" (Dasen et al., 1979). Combined with the use of presumed culture-free tests of levels of differentiation, this dualism is an impediment to understanding how thoroughly the social and object characteristics of the environment are intertwined. It leads to a narrow focus on only one part of the important process by which the child's contact with a physical and a social world is organized. Ignored by this dualism is the work that takes place in "zones of proximal development," that is, those environments—surrounding, yet external to, the child—which assure that there will be a fit between the needs of the child and the external environment.

It is possible to make a strong case for Piaget's

belief in the principled interpenetration of the social and object worlds. But this underlying supposition is really not well represented in the research on which the theory is based. Dasen joins Berry and Witkin in juxtaposing cognitive development to the development of social interactions, even as he calls for reconsidering Piaget's belief that the social and object domains obey the same developmental laws. Although it is true that Piaget uses very similar ideas to account for the structural changes that occur in the social domain and changes in such object-centered domains as conservation, there has been little or no research directed at El'konin's point that objects become social insofar as they interact with people. Nor has there been great success in showing that levels of functioning in one domain correlate well with functioning in the other, as the general stage theory would have us believe.

The root metaphor in Piaget's theory comes from biology, and more specifically, digestion. His model of intellectual development is a metaphoric description of the process of biological growth. In digestion, Piaget tells us, we can see the process by which the organism assimilates food, which undergoes transformations in the process of being accommodated to the existing structure of the organism. Biological growth requires the ingestion of nutrients, the definition or value of which is established by the organism's capacity to process them. These nutrients or "aliments," then become a part of the system, redefining its ability to process future nutrients.

Intellectual growth, for Piaget, operates in a similar fashion. The child, in activity, assimilates new experiences, accommodating mental structures to enable assimilation to be completed. The child can only take in or assimilate those experiences that are defined as relevant by the current state of the processing organization. Once ingested, these experiences form part of the mental organization that will allow for the intake or assimilation of new experiences.

Piaget's work is a relatively faithful embodiment of this biological metaphor in the realm of cognitive development, especially in his discussions of the interactions between an individual and an object. (Cross-cultural research, however, has found it difficult to study the "ingestion process," depending as it does on "digestive products.")

If we extend the digestion analogy a little bit further, we will be able to illustrate the direction we believe Piagetian research needs to take. The biological-nourishment system and the intellectual-experiences system are not determined solely by children's

personal and individual efforts. Piaget treats food as if it were a natural object, encountered in nature in its "raw" form. In fact, the range of such natural foods in human history is very small, and the range of humankind's habitat would be very much reduced if *food as a socially structured object* was not the rule rather than the exception. The very fact that fire came under human control and was used to "prepare" food is evidence of the *social* nature of the object, even in Piaget's root metaphor derived from biology.

Parents carefully plan and prepare the food for their young children. But parents are not the only forces operating in the system that assures that the nutritional needs of infants are attended to. Many cultural systems are involved in the preparation and distribution of food for the young as well as for the old. The fact that a great deal of what we eat has been processed, prepared, and is available at the market prior to any preparation that is done in the home also extends Piaget's digestion metaphor further in an interactional direction.

Just as parents carefully prepare the food that children will consume, so, too, parents (and others in the child's environment), prepare and constrain the type of intellectual experiences to which the child will be exposed. Just as children are not left to their own devices, so parents are not forced to operate in isolation when organizing the intellectual environments of their children. And children contribute to this enterprise by displaying both their nutritional and intellectual states to their parents in ways that are both graphic and vocal.

By analogy to the prepared baby food or to the food-processing devices available to parents, the social distribution of social knowledge in any society provides normative guides for the preparation and distribution of "baby experiences" that will lead to the intellectual growth valued by the culture. It is in these ways and by these cultural practices that all reality can be said to be a social reality. Physical reality is both socially constructed and culturally constrained.

From a cultural-practice point of view, the social nature of a great deal of the child's ordinary interactions with the socially organized world is a central focus. The point we have been making about the social nature of the physical world does not mean that interaction with social objects cannot be distinguished and compared to interaction with social beings. Objects and people are distinguishable by the kinds of interactions they allow. Children will come to master interactions with many objects, but

the nature of those interactions will be shaped by the fact that insofar as they are elements in *human* life, they represent socially tailored objects with habitual patterns of interaction built in. In the case of human artifacts, the patterns are built into their very design. Forms of interaction have to be learned, and this learning occurs in culturally organized contexts.

Social Interaction

In order to explore more deeply the problems facing contemporary theories that seek to integrate social and object domains, we need to contrast the way in which each theory treats the interaction of these two domains. Each theoretical approach— whether its origins lie in central processing or in cultural practice—acknowledges that interaction between social and object domains is central to development; but each differs markedly in its treatment of this difficult topic.

Within psychological differentiation theory, interaction is treated as a hypothetical process intervening between parental and child behavior. For purposes of conducting causal analysis, maternal behaviors, for example, are coded as "stimuli" or antecedent variables and child behaviors as consequences. The nature of the child's contribution to this sequence is basically responsive. B. B. Whiting's (1980) coding scheme adopts a similar strategy, reduced to a subcategory of interactions ("mands") for which it is plausible to assume one can code initiator and responder. In Whiting's work, children's behavior, as well as adults', can be seen in the initiator (stimulus) slot, but *interaction* itself is not represented.

For Piaget, interaction is a more central concept. Because Piaget views the child as an active constructor of its world, he places great emphasis on the idea of *co*operations; that is, operations or mental transformations that are formed in concert with others.

The interdependence of social and cognitive development is evident throughout Piaget's theoretical work (Piaget, 1970, 1971), though he claims it is impossible to draw any causal links between the development of "social logic" and "individual logic." They "constitute inseparable aspects of a single reality" (Piaget, 1968, p. 158).

> In the realm of knowledge, it seems obvious that individual operations of intelligence and operations making for exchange in cognitive cooperations are one and the same thing, the "general conditions of actions" to which we have continually referred being an interindividual as well

as intraindividual coordinator because such "actions can be collective as well as executed by individuals." (Piaget, 1971, p. 360)

Because of this unity, Piagetian research has not focused on the development of *co*operations: they are assumed to follow the same developmental path as operational development. But cross-cultural work has forced on Piagetian scholars the realization that the social interactions within which objects are located have to be studied as constitutive of the operations themselves.[7]

The Interpretation of Experimental Data

Although agreement that the interpretation of psychological test data is especially problematic in cross-cultural research is extremely widespread, views about the nature of the uncertainties involved vary greatly between different positions. At one extreme, theorists believe that problems of stimulus equivalence are susceptible to solution with the standard paradigm of intracultural psychological research (e.g., Berry, 1976; Eckensberger, Lonner, & Poortinga, 1979; and many of the other references listed in our bibliography). At another extreme, investigators believe that several features of the psychological tests used in cross-cultural research render the results totally uninterpretable in terms of people's everyday experiences (Lave, 1980; Wolcott, 1972).

Our own view stems directly from our analysis of the origins of psychological experimentation and our field experience. As discussed in the introductory section of this chapter, cognitive psychological experiments began as models of a very special set of human experiences connected closely with theories of specialized mechanical and electrical technology at the end of the nineteenth century. In search of the basic elements of ideas, which he sought in sensations, Wundt constructed a psychology representing interactions between people and physical stimuli (flashing lights, touches, smells, sounds) that could be rigidly controlled and timed in very brief intervals. The way in which sensations became elementary ideas when combined in consciousness was the activity that Wundt set out to model. As previously mentioned, he despaired of modeling more complex interactions (higher psychological functions) relegating that task to folklore and ethnography.

While varying the nature of the antecedent conditions, psychologists down to the present day have retained Wundt's use of an antecedent/consequence framework as a basic means to enable causal analy-

sis. The linearity of the system, from stimulus to response, was essential, for the causal analysis of feedback systems then, as now, was very weak. Gestalt psychologists rebelled against the narrow definitions of stimulus and response, but like other researchers, maintained the framework.

As a consequence of this early strategic decision, the range of interactions that could serve as a basis for the study of human cognition was severely truncated. In effect, psychologists implemented an "object/person" model of a human being's interactions with the world. Among its many virtues, this strategy made analogies between psychology and the physical sciences plausible and set the parameters of the kinds of interactions that could be used to *define* basic psychological processes. With the advent of operationalism in the 1940s, psychologists accepted the notion that the meaning of the terms used in their theories were strongly shaped, if not completely determined, by the procedures that were used to evoke and study them. Consequently, short-term memory *means* the behavior exhibited in one or more of the tasks used to study it; forgetting, rehearsal, clustering, inference, compensation, disembedding, and other processes are defined in analogous ways. It is commonplace to point out that tests of psychological abilities are culture bound. But it is less common to point out that these tests arose as cultural practices of a very specific sort.

Binet understood this point very well when he set out to construct a test of school-related abilities. Schools arose in Western Europe specifically to induct children into cultural practices central to the society of the time, among which must be counted reading the Bible as the means to individual salvation, creating forms of social interaction conducive to work in a society that was making the transition to mass production, and recognizing the need for increasingly sophisticated modes of technology. Binet understood the limited nature of his behavior samples and objected to their use as general tests of behavior even for the society in which they arose. He was quite right, of course; schooling was intended as a limited environment for the inculcation of a limited set of the skills required of competent adulthood.

Unfortunately, just as Binet's work was taken out of his hands and put outside the school to provide a model of competent functioning in general, so psychological experiments were taken as models of cognitive processes in general, as if the special set of interactions they were designed to represent exhausted the universe of basic human/environment interactions. When taken outside of the systems of

activity that they are designed to model, the fundamental status of behavior in experiments changes. Psychological experiments then cease to be models of that culturally organized activity and become, instead, indeterminate systems of activity, whose correlation with real world models is difficult to specify.

To summarize, psychologists tend to use tests and experiments as measures of the psychological processes that are their basic units of analysis. We are advocating cultural practices as the basic units of analysis. In this view, experiments are models of systems of activity that vary in their goals, the knowledge base they require, and the skills that must be brought to bear in order to achieve the goal. If they are designed as models of recurring systems of activity identified in the culture as routine practices, they are important instruments for the understanding of how culture affects mind.

As models of recurring systems of activity, they are no more or no less "naturally occurring" situations than religious festivals, cockfights, and initiation ceremonies. In both observational and experimental studies, researchers and subjects of research are reflexively related in ways that dissolve simplistic distinctions between "experimental" and "naturally occurring" situations. The cultural practices of twentieth-century industrialized societies, in particular those practices tied closely to technology, are not uniformly distributed in all cultures. Consequently, the model systems that have been developed in these cultural surroundings cannot be assumed to be models of activity in other cultural settings, although they may be. That is a matter for empirical investigation.

It is these kinds of consideration that have led to our earlier emphasis on a theory of situations as an essential aspect of a theory of culture and cognition. Until we can "locate" the experiment with respect to the cultural practices it is intended to model, we cannot make proper headway on interpreting the results that we obtain (Scribner, 1975).

As a consequence of this position, experimentation takes on a very different role in a cultural-practice theory than it does in the central-processor approaches described earlier, where the environment of experiment or test is a universal measure of process. Ideally, cross-cultural experimentation should begin with an analysis of everyday practices and proceed to the construction of model systems to explore the analyst's interpretation of what he or she is observing. This approach uses tasks found in naturally occurring, everyday situations (e.g., situations not designed to study general psychological pro-

cesses). A model of the structure of the task is then constructed in terms that map the native informant's conceptions. These cultural practices, if described with sufficient formal rigor, become useful domains for comparative analysis (Hutchins, 1980; Lave, n.d.; Quinn, 1976, 1978).

Less than ideally, standard experiments can be used as a starting point of analysis that leads to a search for cultural practices that contain enough constraints in common with the model system to make a claim that the experiment is a model of indigenous practice. The latter approach was used in the work of Cole and others (1971) and is close in spirit to research strategies recommended by Berry and Dasen (1974).

Examples of cultural practices from other cultures suggest just how far the standard psychological experiment is from routine systems of activity. As discussed at length in Bartlett (1958), Cole and others (1978), Lave (1979, 1980), and Vygotsky (1978), there are many differences to be noted between behavior demanded in experiments and problem-solving contexts of everyday life. This reflects the fact that standard experiments are models of schooling, and only part of schooling at that, so we should not be surprised at the discrepancy. It should put us on our guard, however, because the nonrepresentativeness we have been concerned about in cross-cultural work is an issue in our own society. This point is brought home by the work of D'Andrade (1974), Shweder (1977), and Wason and Johnson-Laird (1972), who demonstrate that the everyday thinking of American adults has many of the properties previously attributed as characteristic of nonliterate peoples. It should be noted, too, that efforts in domestic developmental cognitive work to make experiments more closely model young children's experience of the world greatly increase our estimates of the abilities that children possess (Flavell & Ross, 1981; Gelman, 1978; Shweder, Turiel, & Much, 1981).

The Future of Cross-cultural Studies of Culture and Cognition

Our prognostications follow directly from our framework. There is very little in the way of independent invention in the history of human ideas. Change comes about through interaction, where significant discrepancies between our current theory and reality are thrust upon us, where some more inclusive theory is made salient, and where the environment supports higher order generalizations in limited domains. The study of culture and cognition is a true *inter*discipline. Between the domain of the

psychologist and anthropologist, it studies that zone of proximal development where the cultural becomes individual and individuals create their culture. This view is a return to the nineteenth-century belief that mind and culture are different aspects of the same phenomenon, a view only slightly modified by the enormous increase in practice and the many local-level insights chronicled in these pages.

NOTES

1. Tylor acknowledged, but did not build on, the fact that "if not only knowledge and art, but at the same time moral and political excellence be taken into consideration, it becomes more difficult to scale societies from lower to higher stages of culture" (1874, p. 29).

2. In an important sense "cultural diffusion" of ideas in anthropological theory is analogous to the "diffusion" of real world knowledge into the controlled, introspective report of a Titchnerian subject; both were attributed to obscure causal sequences in the theories that dominated the period.

3. According to Boas, foreign material adopted by a culture was "adopted and changed in form according to the genius of the people who borrowed it" (quoted in Stocking, 1968, p. 214).

4. Dasen discusses an important difficulty with the studies of décalage: the effects of cultural variables are not discernible in group statistics that present population frequencies of responses at different ages. Individual longitudinal studies would serve to uncover differences in hierarchical development, but such studies are absent from the cross-cultural literature.

5. These studies serve as examples of the way the general ecocultural model discussed in the previous section uses performance on a particular test as an index of *general* cognitive ability—in this case, perception—and then relates this capacity to *general* aspects of the ecological/social network.

6. A complementary view of the relation between mind and society is found in American pragmatism. The most comprehensive elaboration of the pragmatist theory was developed by G. H. Mead (1934). "The behavior of an individual can be understood only in terms of the whole social group of which he is a member, since his individual social acts are involved in larger, social acts which go beyond himself" (Mead, 1934).

7. Recently a group of Genevan scholars (Doise, Mugny, & Perret-Clermont, 1975; Perret-Clermont, 1980) have been pursuing the implications of this line of thinking.

REFERENCES

Armah, K., & Arnold, M. *Acquisition of conservation in Ghanaian children*. Paper presented at the meeting of the Society for Research in Child Development, New Orleans, 1977.

Barker, R. G. *Ecological psychology: Concepts and methods for studying the environment of human behavior*. Stanford: Stanford University Press, 1968.

Barry, H., Bacon, M., & Child, I. A cross-cultural survey of sex differences and socialization. *Journal of Abnormal Social Psychology*, 1957, *3*, 55.

Barry, H., Child, I., & Bacon, M. Relation of child training to subsistence economy. *American Anthropologist*, 1959, *61*, 51–63.

Bartlett, F. C. *Thinking*. New York: Basic Books, 1958.

Bayley, N. Comparisons of mental and motor test scores for ages 1–15 months by sex, birth order, race, geographic location, and education of parents. *Child Development*, 1965, *36*, 379–411.

Bem, D. J., & Allen, A. On predicting some of the people some of the time. *Psychological Review*, 1974, *81*, 506–520.

Benedict, R. *Patterns of culture*. Boston: Houghton Mifflin, 1934.

Berry, J. W. On cross-cultural comparability. *International Journal of Psychology*, 1969, *4*, 119–128.

Berry, J. W. *Human ecology and cognitive style*. New York: Sage-Halsted, 1976.

Berry, J. W., & Dasen, P. R. (Eds.), *Culture and cognition: Readings in cross-cultural psychology*. London: Methuen, 1974.

Blurton-Jones, N. G., & Konner, M. J. Sex differences in the behavior of Bushman and London two- to five-year-olds. In J. Crook & R. Michael (Eds.), *Comparative ecology and behavior of primates*. New York: Academic Press, 1973.

Boas, F. *The mind of primitive man*. New York: The Macmillan Co., 1911.

Bock, P. K. *Continuities in psychological anthropology*. San Francisco: Freeman, 1980.

Boonsong, S. *The development of conservation of mass, weight and volume in Thai children*. Unpublished master's thesis. Bangkok, College of Education, 1968.

Bovet, M. C. Cognitive processes among illiterate children and adults. In J. W. Berry & P. R. Dasen (Eds.), *Culture and cognition: Readings in cross-cultural psychology*. London: Methuen, 1974.

Bovet, M. C., & Othenin-Girard, C. Etude Piage-

tienne de quelques notions spatio-temporelles dans un milieu africain. *Journal International de Psychologie*, 1975, *10* (1), 1–17.

Brazelton, T. B., Koslosowski, B., & Main, M. The origins of reciprocity: The early mother-infant interactions. In M. Lewis & L. A. Rosenblum, (Eds.), *The effect of the infant on its caregivers*. New York: Wiley, 1974.

Bruner, J., Olver, R., & Greenfield, P. *Studies in cognitive growth*. New York: Wiley, 1966.

Cantor, N. & Mischel, W. Prototypes in person perception. In *Advances in Experimental Social Psychology*, 1979, *12*, 3–52.

Casati, I., & Lezine, I. *Les étapes de l'intelligence sensori-motrice. Manuel*. Paris: Centre de Psychologie Appliquée, 1968.

Cazden, C. B. Performance before competence: Assistance to child discourse in the zone of proximal development. *The Quarterly Newsletter of the Laboratory of Comparative Human Cognition*, 1981, *3*, 5–8.

Chamberlain, A. F. *The child: A study in the evolution of man*. London: Walter Scott, 1901.

Childs, C. P., & Greenfield, P. M. Informal modes of learning and teaching: The case of Zinacanteco weaving. In N. Warren (Ed.), *Advances in cross-cultural psychology* (Vol. 2). London: Academic Press, 1982.

Cicourel, A. V. *Cognitive sociology: Language and meaning in social interaction*. London: Penguin, 1973.

Cole, M. An ethnographic psychology of cognition. In R. W. Brislin, S. Bochner, & W. J. Lonner (Eds.), *Cross-cultural perspectives on learning*. New York: Halsted Press, 1975.

Cole, M., Gay, J., Glick, J. A., & Sharp, D. W. *The cultural context of learning and thinking*. New York: Basic Books, 1971.

Cole, M., & Griffin, P. Cultural amplifiers reconsidered. In D. Olson (Ed.), *Social foundations of language and thought*. New York: Norton, 1980.

Cole, M., Hood, L., & McDermott, R. P. *Ecological niche picking: Ecological invalidity as an axiom of experimental cognitive psychology*. Unpublished manuscript, University of California, San Diego, & The Rockefeller University, 1978.

Corman, H. H., & Escalona, S. K. Stages of sensorimotor development: A replication study. *Merrill-Palmer Quarterly*, 1969, *15*, 351–362.

Cryns, A. G. J. African intelligence: A critical survey of cross-cultural intelligence research in Africa south of the Sahara. *Journal of Social Psychology*, 1962, *57*, 283–301.

D'Andrade, R. G. Memory and assessment of be-

havior. In H. M. Blalock, Jr. (Ed.), *Measurement in the social sciences*. Chicago: Aldine, 1974.

Dasen, P. R. *Cognitive development in Aborigines of central Australia: Concrete operations and perceptual activities*. Unpublished doctoral dissertation. Canberra: Australian National University, 1970.

Dasen, P. R. Cross-cultural Piagetian research: A summary. *Journal of Cross-Cultural Psychology*, 1972, *3* (1), 29–39.

Dasen, P. R. The influence of ecology, culture and European contact on cognitive development in Australian Aborigines. In J. W. Berry & P. R. Dasen (Eds.), *Culture and cognition*. London: Methuen, 1974.

Dasen, P. R. (Ed.). *Piagetian psychology: Cross-cultural contributions*. New York: Gardner, 1977.

Dasen, P. R. Psychological differentiation and operational development: A cross-cultural link. *The Quarterly Newsletter of the Laboratory of Comparative Human Cognition*, 1980, *2* (4), 81–86.

Dasen, P. R., Berry, J. W., & Witkin, H. A. The use of developmental theories cross-culturally. In L. Eckensberger, W. Lonner, & Y. H. Poortinga (Eds.), *Cross-cultural contributions to psychology*. The Netherlands: Swets Publishing Service, 1979.

Dasen, P. R., & Heron, A. Cross-cultural tests of Piaget's theory. In H. C. Triandis & A. Heron (Eds.), *Handbook of cross-cultural psychology: Developmental psychology* (Vol. 4). Boston: Allyn & Bacon, 1981.

Dasen, P. R., Inhelder, B., Lavallée, M., & Reschitzki, J. *La naissance de l'intelligence chez l'enfant Baoulé de la Côte d'Ivoire*. Berne: Huber, 1978.

Dasen, P. R., Ngini, L., & Lavallée, M. Cross-cultural training studies of concrete operations. In L. H. Eckensberger, W. J. Lonner, & Y. H. Poortinga (Eds.), *Cross-cultural contributions to psychology*. Amsterdam: Swets & Zeitlinger, 1979.

deLemos, M. M. The development of conservation in Aboriginal children. *International Journal of Psychology*, 1969, *4*, 225–269.

Dempsey, A. D. Time conservation across cultures. *International Journal of Psychology*, 1971, *6*, 115–120.

Doise, W., Mugny, G., & Perret-Clermont, A. Social interaction and the development of cognitive operations. *European Journal of Social Psychology*, 1975, *5*, 367–383.

Eckensberger, L., Lonner, W., & Poortinga, Y. H. (Eds.). *Cross-cultural contributions to psychology*. The Netherlands: Swets & Zeitlinger, 1979.

El'konin, D. B. Toward the problem of stages in the mental development of the child. *Soviet Psychology*, 1972, *10*, 225–251.

Erickson, F., & Schultz, J. When is a context? *The Quarterly Newsletter of the Institute for Comparative Human Development*, 1977, *1*, 5–10.

Fjellman, J. A. S. *The myth of primitive mentality: A study of semantic acquisition and modes of categorization in Akamba children of South Central Kenya*. Doctoral dissertation, Stanford University, 1971.

Flavell, J. H., & Ross, L. (Eds.), *Social cognitive development*. Cambridge: Cambridge University Press, 1981.

Flavell, J. H., & Wohlwill, J. F. Formal and functional aspects of cognitive development. In D. Elkind & J. H. Flavell (Eds.), *Studies in cognitive development*. New York: Oxford University Press, 1969.

Fortes, M. Social and psychological aspects of education in Taleland. In J. Middleton (Ed.), *From child to adult: Studies in the anthropology of education*. New York: Natural History Press, 1970.

Frake, C. O. Plying frames can be dangerous: Some reflections on methodology in cognitive anthropology. *The Quarterly Newsletter of the Institute for Comparative Human Development*, 1977, *1*, 1–7.

Garfinkel, H. *Studies in ethnomethodology*. Englewood Cliffs, N.J.: Prentice-Hall, 1967.

Gay, J. *Red dust on green leaves*. East Glastenburg, Conn.: Inter-Culture Associates, 1973.

Gay, J., & Cole, M. *The new mathematics and an old culture*. New York: Holt, Rinehart & Winston, 1967.

Geber, M. La récherche sur le développment psychomoteur et mental à Kampala. *Compte-rendu de la XII réunion des équipes chargées des études sur la croissance et de développment de l'enfant normal*. Paris: Center Internationale de l'Enfance, 1974.

Geber, M., & Dean, R. F. A. Gesell tests on African children. *Pediatrics*, 1957, *20*, 1055–1065.

Geber, M., & Dean, R. F. A. Psychomotor development in African children: The effects of proved tests. *Bulletin of the World Health Organization*, 1958, *18*, 471–476.

Geertz, C. *The interpretation of cultures*. New York: Basic Books, 1973.

Gelb, I. J. *A study of writing* (Rev. ed.). Chicago: University of Chicago Press, 1963.

Gelman, R. Cognitive development. *Annual Review of Psychology*, 1978, *29*, 297–332.

Gesell, A., & Amatruda, C. S. *Developmental diagnosis* (2nd ed.). New York: Hoeber, 1947.

Gick, M. L., & Holyoak, K. J. Analogical problem solving. *Cognitive Psychology*, 1980, *12*, 306–355.

Glick, J. A. Cognitive development in cross-cultural perspective. In T. D. Horowitz et al. (Eds.), *Review of child development research*. Chicago: University of Chicago Press, 1975.

Goldberg, S. Infant care and growth in urban Zambia. *Human Development*, 1972, *15*, 77–89.

Goodenough, D. R., & Karp, S. A. Field dependence and intellectual functioning. *Journal of Abnormal and Social Psychology*, 1961, *63*, 241–246.

Goodenough, W. Cultural anthropology and linguistics. In D. Hymes (Ed.), *Language in culture and society*. New York: Harper & Row, 1964.

Goodnow, J. J. A test of milieu differences with some of Piaget's tasks. *Psychological Monographs*, 1962, *76*, 36.

Goodnow, J. J. Rules and repertoires, rituals and tricks of the trade: Social and informational aspects to cognitive and representational development. In S. Farnham-Diggory (Ed.), *Information processing in children*. New York: Academic Press, 1969.

Goodnow, J. J., & Bethon, G. Piaget tasks: The effects of schooling and intelligence. *Child Development*, 1966, *37*, 573–582.

Goody, J., & Watt, I. The consequences of literacy. In J. Goody (Ed.), *Literacy in traditional societies*. Cambridge: Cambridge University Press, 1968. (Originally published in *Comparative studies in society and history*, 1963, *5*, 27–68.)

Gould, S. J. *Ontogeny and phylogeny*. Cambridge: Harvard University Press, 1976.

Grantham-McGregor, S. M., & Hawke, W. A. Developmental assessment of Jamaican infants. *Developmental Medicine and Child Neurology*, 1971, *13*, 582–589.

Greenfield, P. M. On culture and conservation. In J. S. Bruner, R. P. Olver, & P. M. Greenfield (Eds.), *Studies in cognitive growth*. New York: Wiley, 1966.

Greenfield, P. M. Oral and written language: The consequences for cognitive development in Africa, the United States, and England. *Language and Speech*, 1972, *15*, 169–178.

Greenfield, P. M. Comparing dimensional categorization in natural and artificial contexts: A devel-

opmental study among the Zinacantecos of Mexico. *Journal of Social Psychology*, 1974, *93*, 157–171.

Greenfield, P. M. Cross-cultural research and Piagetian theory: Paradox and progress. In K. F. Riegel & J. A. Meacham (Eds.), *The developing individual in a changing world: Historical and cultural issues* (Vol. 1). Chicago: Aldine, 1976.

Harkness, S., Edwards, C. P., & Super, C. M. *Kohlberg in the bush*. Paper presented at the meeting of the Society for Cross-Cultural Research, East Lansing, Mich., 1977.

Harris, M. *The rise of anthropological theory*. New York: Crowell, 1968.

Havelock, E. A. *The Greek concept of justice: From its shadow in Homer to its substance in Plato*. Cambridge, Mass.: Harvard University Press, 1978.

Heron, A. Concrete operations, 'g' and achievement of Zambian children: A non-verbal approach. *Journal of Cross-Cultural Psychology*, 1971, *2*, 325–336.

Heron, A. Cultural determinants of concrete operational behavior. In J. L. M. Dawson & W. J. Lonner (Eds.), *Readings in cross-cultural psychology*. Hong Kong: Hong Kong University Press, 1974.

Hutchins, E. *Culture and inference*. Cambridge, Mass.: Harvard University Press, 1980.

Inhelder, B., & Piaget, J. *The growth of logical thinking from childhood to adolescence*. New York: Basic Books, 1958.

Irvine, J. Wolof "Magical thinking: Culture and conservation revisited." *Journal of Cross-Cultural Psychology*, 1978, *9*.

Irwin, M., Engle, P. L., Klein, R. E., & Yarbrough, C. Traditionalism and field dependence. *Journal of Cross-Cultural Psychology*, 1976, *7* (4), 463–471.

Irwin, M. H., Schafer, G. N., & Feiden, C. P. Emic and unfamiliar category sorting of Mano farmers and U.S. undergraduates. *Journal of Cross-Cultural Psychology*, 1974, *5*, 407–423.

Jahoda, G. Theoretical and systematic approaches in cross-cultural psychology. In H. C. Triandis & W. W. Lambert (Eds.), *Handbook of cross-cultural psychology* (Vol. 1). Boston: Allyn & Bacon, 1980.

Jensen, A. R. *Bias in mental testing*. New York: Free Press, 1980.

Kamara, A. I. *Cognitive development among school-age Themne children of Sierra Leone*. Doctoral dissertation, University of Illinois, 1971.

Kamara, A. I., & Easley, J. A., Jr. Is the rate of cognitive development uniform across cultures?—A methodological critique with new evidence from Themne children. In P. R. Dasen (Ed.), *Piagetian psychology: Cross-cultural contributions*. New York: Gardner, 1977.

Kardiner, A. *The psychological frontiers of society*. New York: Columbia University Press, 1945.

Kearins, J. M. Visual spatial memory in Australian Aboriginal children of desert regions. *Cognitive Psychology*, 1981, *3* (4), 434–460.

Kelly, M. Papua New Guinea and Piaget—An eight-year study. In P. R. Dasen (Ed.), *Piagetian psychology: Cross-cultural contributions*. New York: Gardner, 1977.

Kilbride, J. E., & Kilbride, P. L. Sitting and smiling behavior of Baganda infants: The influence of culturally constituted experiences. *Journal of Cross-cultural Psychology*, 1975, *6*, 88–106.

Kiminyo, D. M. A cross-cultural study of the development of conservation of mass, weight, and volume among Kamba children. In P. R. Dasen (Ed.), *Piagetian psychology: Cross-cultural contributions*. New York: Gardner, 1977.

Kirk, L. Maternal and subcultural correlates of cognitive growth rate: The Ga pattern. In P. R. Dasen (Ed.), *Piagetian psychology: Cross-cultural contributions*. New York: Gardner, 1977.

Kirk, L., & Burton, M. Meaning and context: A study of contextual shifts in meaning of Maasai personality descriptors. *American Ethnologist*, 1977, *4* (4), 734–761.

Kopp, C. B., Khokha, E., & Sigman, M. A comparison of sensory-motor development among infants in India and the United States. *Journal of Cross-Cultural Psychology*, 1977, *8*, 435–452.

Kulah, A. A. *The organization and learning of proverbs among the Kpelle of Liberia*. Unpublished doctoral dissertation, University of California, Irvine, 1973.

Laboratory of Comparative Human Cognition. Cognition as a residual category in anthropology. *Annual Review of Anthropology*, 1978, *7*, 51–69.

Laboratory of Comparative Human Cognition. What's cultural about cross-cultural cognitive psychology? *Annual Review of Psychology*, 1979, *30*, 145–172.

Laboratory of Comparative Human Cognition. Culture and intelligence. In R. Sternberg (Ed.), *Handbook of human intelligence*. New York: Cambridge University Press, in press.

Lancy, D. F. Studies of memory in culture. *Annals of the New York Academy of Science*, 1977, *307*, 285–297.

Lantz, D. A cross-cultural comparison of communication abilities: Some effects of age, schooling and culture. *International Journal of Psychology*, 1979, *14*, 171–183.

Laurendeau-Bendavid, M. Culture, schooling, and cognitive development: A comparative study of children in French Canada and Rwanda. In P. R. Dasen (Ed.), *Piagetian psychology: Cross-cultural contributions*. New York: Gardner, 1977.

Lave, J. *A model of everyday problem solving*. Talk presented to an SSRC Committee on Cognition symposium. La Jolla, Calif., August 1979.

Lave, J. What's special about experiments as contexts for thinking. *The Quarterly Newsletter of the Laboratory of Comparative Human Cognition*, 1980, *2* (4), 86–91.

Lave, J. *Apprenticeship and a cultural theory of learning*. Unpublished manuscript, University of California, Irvine.

Lee, R. B., & DeVore, I. (Eds.). *Kalahari hunter-gatherers*. Cambridge, Mass.: Harvard University Press, 1976.

Leiderman, P. H., Tulkin, S. R., & Rosenfeld, A. (Eds.). *Culture and infancy: Variations in the human experience*. New York: Academic Press, 1977.

Leont'ev, A. N. *Activity, consciousness, and personality*. Englewood Cliffs, N.J.: Prentice-Hall, 1978.

Leont'ev, A. N. The problem of activity in psychology. In J. V. Wertsch (Ed.), *The concept of activity in Soviet psychology*. White Plains, N.Y.: Sharpe, 1981.

LeVine, R. A. Cross-cultural study in child psychology. In P. H. Mussen (Ed.), *Carmichael's Manual of Child Psychology* (3rd ed.) (Vol. 2). New York: Wiley, 1970.

LeVine, R. A. *Culture, behavior, and personality*. Chicago: Aldine, 1973.

LeVine, R. A. Parental goals: A cross-cultural view. In H. J. Leichter (Ed.), *The family as educator*. New York: Teachers College Press, 1974.

Luria, A. R. *Cognitive development*. Cambridge, Mass.: Harvard University Press, 1976.

MacArthur, R. S. Some ability patterns: Central Eskimos and Nsenga Africans. *International Journal of Psychology*, 1973, *8*, 239–247.

Malinowski, B. *The father in primitive psychology*. New York: Norton, 1927.

McDermott, R. P., & Roth, D. R. The social organization of behavior: Interactional approaches. *Annual Review of Anthropology*, 1978, *7*, 321–345.

McElwain, D. W., & Kearney, G. E. Intellectual development. In G. E. Kearney, P. R. deLacey, & G. R. Davidson (Eds.), *The psychology of Aboriginal Australians*. Sydney: Wiley, 1973.

McFie, J. The effect of education on African performance on a group of intellectual tests. *British Journal of Educational Psychology*, 1961, *31*, 232–240.

McLuhan, M. *The Gutenberg galaxy*. Toronto: University of Toronto Press, 1962.

Mead, G. H. *Mind, self, and society*. Chicago: University of Chicago Press, 1934.

Mead, G. H. *The philosophy of the present*. Chicago: Open Court Press, 1954.

Mead, M. *Continuities and discontinuities in cultural evolution*. New Haven: Yale University Press, 1958.

Mehan, H., & Griffin, P. Socialization: A view from classroom interaction. *Sociological Inquiry*, 1980, *50* (3–4), 357–392.

Mosheni, N. *La comparaison des réactions aux épreuves d'intelligence en Iran et en Europe*. Unpublished thesis, University of Paris, 1966.

Munroe, R. H., Munroe, R. L., & Whiting, B. B. (Eds.) *Handbook of cross-cultural human development*. New York: Garland STPM Press, 1981.

Neimark, E. D. Intellectual development during adolescence. In F. D. Horowitz (Ed.), *Review of child development research* (Vol. 4). Chicago: University of Chicago Press, 1975.

Nisbett, R., & Ross, L. *Human inference: Strategies and shortcomings of social judgement*. Englewood Cliffs, N.J.: Prentice-Hall, 1980.

Nyiti, R. M. *A study of conservation among Meru children of Tanzania*. Doctoral dissertation, University of Illinois, 1973.

Nyiti, R. M. The development of conservation in the Meru children of Tanzania. *Child Development*, 1976, *47*, 1122–1129.

Okonji, M. O. The differential effects of rural and urban upbringing on the development of cognitive styles. *International Journal of Psychology*, 1969, *4*, 293–305.

Olson, D. R. From utterance to text: The bias of language in speech and writing. *Harvard Educational Review*, 1977, *47*, 257–281.

Opper, S. Concept development in Thai urban and rural children. In P. R. Dasen (Ed.), *Piagetian psychology: Cross-cultural contributions*. New York: Gardner, 1977.

Otaala, B. *The development of operational thinking in primary school children: An examination of some aspects of Piaget's theory among the Itseo children of Uganda*. Doctoral dissertation, Teacher's College, Columbia University, 1971.

Peluffo, N. Culture and cognitive problems. *International Journal of Psychology*, 1967, *2* (3), 187–198.

Perret-Clermont, A. N. *Social interaction and cognitive development in children* (European Monographs in Social Psychology, H. Tajfel, Ed.). New York: Academic Press, 1980.

Piaget, J. *The language and thought of the child.* New York: World, 1955.

Piaget, J. *The origins of intelligence in children.* New York: Norton, 1963.

Piaget, J. Nécessité et signification des recherches comparatives en psychologie génétique. *Journal International de Psychologie,* 1966, *1,* 3–13.

Piaget, J. *Six psychological studies.* New York: Vintage, 1968.

Piaget, J. Piaget's theory. In P. H. Mussen (Ed.), *Carmichael's manual of child psychology* (3rd ed.). New York: Wiley, 1970.

Piaget, J. *Le structuralisme* (Que sais-je?). Paris: Presses universitaries de France, 1971.

Piaget, J. Intellectual evolution from adolescence to adulthood. *Human Development,* 1972, *15,* 1–12.

Piaget, J. *The psychology of intelligence.* Totowa, N.J.: Littlefield & Adams, 1973.

Piaget, J. Need and significance of cross-cultural studies in genetic psychology. In J. W. Berry & P. R. Dasen (Eds.), *Culture and cognition: Readings in cross-cultural psychology.* London: Methuen, 1974.

Piaget, J. *The development of thought: Equilibration of cognitive structures.* New York: Viking, 1977.

Pinard, A., Morin, C., & Lefebvre, M. Apprentissage de la conservation des quantités liquides chez des enfants Rwandais et Canadiens-Français. *Journal International de Psychologie,* 1973, *8* (1), 15–24.

Price-Williams, D. R. Abstract and concrete modes of classification in a primitive society. *British Journal of Educational Psychology,* 1962, *32,* 50–61.

Price-Williams, D. R. Concrete and formal operations. In R. H. Munroe, R. L. Munroe, & B. B. Whiting (Eds.), *Handbook of cross-cultural human development.* New York: Garland STPM Press, 1981.

Prince, J. R. The effect of Western education on science conceptualization in New Guinea. *British Journal of Educational Psychology,* 1968, *38,* 64–74.

Prince, J. R. *Science concepts in a Pacific culture.* Sydney: Angus & Robertson, 1969.

Quinn, N. A natural system used in infants litigation settlement. *American Ethnologist,* 1976, *3,* 331–361.

Quinn, N. Do Mfantse fish sellers estimate probabilities in their heads? *American Ethnologist,* 1978, *5,* 206–226.

Raum, O. F. *Chaga childhood.* London: Oxford University Press, 1940.

Reed, S. K., Ernst, G. W., & Banerji, R. The role of analogy in transfer between similar states. *Cognitive Psychology,* 1974, *6,* 436–450.

Rogoff, B. Spot observation: An introduction and examination. *The Quarterly Newsletter of the Institute for Comparative Human Development,* 1978, *2* (2), 1–25.

Rogoff, B. Schooling and the development of cognitive skills. In H. C. Triandis & A. Heron (Eds.), *Handbook of cross-cultural psychology* (Vol. 4). Boston: Allyn & Bacon, 1981.

Rogoff, B., & Waddell, K. J. *Memory for an organized scene: A cross-cultural comparison.* Paper presented at the meeting of the Western Psychological Association, Honolulu, 1980.

Sahlins, M. D., & Service, E. R. (Eds.). *Evolution and culture.* Ann Arbor: University of Michigan Press, 1960.

Saxe, G. B. A comparative analysis of the acquisition of numeration: Studies from Papua New Guinea. *The Quarterly Newsletter of the Laboratory of Comparative Human Cognition,* 1979, *1* (3), 37–43.

Schank, R. C., & Abelson, R. P. *Scripts, plans, goals, and understanding: An inquiry into human knowledge structures.* Hillsdale, N.J.: Erlbaum, 1977.

Schmandt-Besserat, D. The earliest precursor of writing. *Scientific American,* 1978, *238* (6), 50–59.

Schutz, A. *Collected papers: The problem of social reality* (Vol. 1). The Hague: Martinus Nijoff, 1962.

Scribner, S. Recall of classical syllogisms: A cross-cultural investigation of error on logical problems. In R. Falmagne (Ed.), *Reasoning: Representation and process.* Hillsdale, N.J.: Erlbaum, 1975.

Scribner, S. *Cultural practice and cognitive skills.* Paper presented at the meeting of the American Anthropological Association, Houston, 1977.

Scribner, S., & Cole, M. Cognitive consequences of formal and informal education. *Science,* 1973, *182,* 553–559.

Scribner, S., & Cole, M. Literacy without schooling: Testing for intellectual effects. *Harvard Ed-*

ucational Review, 1978, 48, (4), 448–461.

Scribner, S., & Cole, M. The consequences of literacy. Cambridge, Mass.: Harvard University Press, 1981.

Serpell, R. The influence of language, education and culture on attentional preference between colour and form. International Journal of Psychology, 1969, 4, 183–194.

Serpell, R. Culture's influence on behaviour. London: Methuen, 1976.

Serpell, R. How specific are perceptual skills? A cross-cultural study of pattern reproduction. British Journal of Psychology, 1979, 70, 365–380.

Sharp, D. W., Cole, M., & Lave, C. Education and cognitive development: The evidence from experimental research. Monographs of the Society for Research in Child Development, 1979, 44 (Serial No. 178), 1–2.

Shweder, R. A. Likeness and likelihood in everyday thought: Magical thinking in judgments about personality. Current Anthropology, 1977, 18, 637–648. (Reprinted in P. N. Johnson-Laird & P. C. Wason (Eds.), Thinking: Readings in cognitive science. London: Cambridge University Press, 1978.)

Shweder, R. A. Rethinking culture and personality theory: A critical examination of two classical postulates (Part 1). Ethos, 1979, 7, 255–278. (a)

Shweder, R. A. Rethinking culture and personality theory: A critical examination of two classical postulates (Part 2). Ethos, 1979, 7, 279–311. (b)

Shweder, R. A. Rethinking culture and personality theory: From genesis and typology to hermeneutics and dynamics (Part 3). Ethos, 1980, 8, 60–94.

Shweder, R. A., Turiel, E., & Much, N. C. The moral intuitions of the child. In J. H. Flavell & L. Ross (Eds.), Social cognitive development. Cambridge: Cambridge University Press, 1981.

Siann, G. Measuring field dependence in Zambia. International Journal of Psychology, 1972, 7, 87–96.

Spencer, H. First principles. New York: Appleton, 1864.

Spencer, H. The principles of psychology (Vol. 5). New York: Appleton, 1886.

Stefflre, V. J. Simulation of people's behavior toward new objects and events. American Behavioral Scientist, 1965, 8 (9), 12–15.

Stocking, G. Race, culture and evolution. New York: Free Press, 1968.

Strauss, S., Ankori, M., Orpaz, N., & Stavy, R. Schooling effects on the development of propor-

tional reasoning. In Y. H. Poortinga (Ed.), Basic problems in cross-cultural psychology. Amsterdam: Swets & Scitlinger, 1977.

Super, C. M. Environmental effects on motor development: The case of African infant precocity. Developmental Medicine and Child Neurology, 1976, 18 (5), 561–567.

Super, C. M. Behavioral development in infancy. In R. H. Munroe, R. L. Munroe, & B. B. Whiting (Eds.), Handbook of cross-cultural human development. New York: Garland STPM Press, 1981.

Super, C. M., & Harkness, S. The infants' niche in rural Kenya and metropolitan America. In L. L. Adler (Ed.), Issues in cross-cultural research. New York: Academic Press, 1980.

Super, C. M., Harkness, S., & Baldwin, L. M. Category behavior in natural ecologies and in cognitive tests. The Quarterly Newsletter of the Institute for Comparative Human Development, 1977, 1, 4–7.

Triandis, H. C., & Lambert, W. W. (Eds.), Handbook of cross-cultural psychology (Vol. 1). Boston: Allyn & Bacon, 1980.

Tulviste, P. On the origins of theoretic syllogistic reasoning in culture and the child. The Quarterly Newsletter of the Laboratory of Comparative Human Cognition, 1979, 1 (4), 73–80.

Tylor, E. B. Primitive culture. London: Murray, 1874.

Tylor, E. B. The origins of culture. New York: Harper, 1958.

Uzgiris, I., & Hunt, J. M. Assessment in infancy. Ordinal scales of psychological development. Urbana: University of Illinois Press, 1975.

Vernon, P. E. Intelligence and cultural environment. London: Methuen, 1969.

Voloshinov, V. N. Marxism and the philosophy of language. New York: Academic Press, 1973.

Vygotsky, L. S. Sobranie Psikhologichescii Issledovanie (Selected psychological investigations). Moscow: Akad Ped Nauk RSFSR, 1956.

Vygotsky, L. S. Thought and language. Cambridge, Mass.: MIT Press, 1962.

Vygotsky, L. S. Mind in society: The development of higher psychological processes (M. Cole, V. John-Steiner, S. Scribner, & E. Souberman, Eds.). Cambridge, Mass.: Harvard University Press, 1978.

Wagner, D. A. The effects of formal schooling on cognitive style. Journal of Social Psychology, 1978, 106, 145–151.

Wason, P. C., & Johnson-Laird, P. N. Psychology of reasoning: Structure and content. London:

Batsford, 1972.

Werner, E. E. *Cross-cultural child development*. Monterey, Calif.: Brooks/Cole, 1979.

Werner, H. *Comparative psychology of mental development*. New York: Science Editions, 1948.

Wertsch, J. V. Adult-child interaction and the roots of metacognition. *The Quarterly Newsletter of the Institute for Comparative Human Development*, 1978, *2*, 15–18.

Wertsch, J. V. *A state of the art review of Soviet research in cognitive psychology*. Manuscript, Department of Linguistics, Northwestern University, 1979.

Wertsch, J. V. The significance of dialogue in Vygotsky's account of social, egocentric and inner speech. *Contemporary educational psychology*, 1980, *5*, 150–162.

Wertsch, J. V. *Adult-child interaction as a source of self-regulation in children*. Paper presented at conference entitled "The Growth of Insight during Childhood." University of Wisconsin-Madison, October 1979. (Revised version to appear in S. Yussen (Ed.), *The growth of insight during childhood*. New York: Academic Press, in press.

Wertsch, J., McNamee, G. D., McLane, J. B., & Budwig, N. A., The adult-child dyad as a problem solving system. *Child Development*, 1980, *51*, 1215–1221.

White, L., *The science of culture*. New York: Wiley, 1949.

Whiting, B. B: Culture and social behavior: A model for the development of social behavior, *Ethos*, 1980, *8*, 95–116.

Whiting, B. B., Whiting, J. W. M. *Children of six cultures: A psychocultural analysis*. Cambridge, Mass.: Harvard University Press, 1975.

Whorf, B. L. *Language, thought and reality*. New York: Wiley, 1956.

Witkin, H. A., & Berry, J. W. Psychological differentiation in cross-cultural perspective. *Journal of Cross-Cultural Psychology*, 1975, *6* (1).

Witkin, H. A., Dyk, R. B., Faterson, H. F., Goodenough, D. R., & Karp, S. A. *Psychological differentiation*. New York: Wiley, 1962.

Wober, M. Sensotypes. *Journal of Social Psychology*, 1966, *70*, 181–189.

Wober, M. *Psychology in Africa*. London: International African Institute, 1975.

Wolcott, H. Cognitive development of primitive peoples: A review of Cole et al. *The cultural context of learning and thinking. Phi Beta Kappan*, 1972.

Zaporozhets, A. V. Thought and activity in children. *Soviet Psychology*, 1980, *18* (2), 9–23.

Za'rour, G. I., & Khuri, G. A. The development of the concept of speed by Jordanian school children in Amman. In P. R. Dasen (Ed.), *Piagetian psychology: Cross-cultural contributions*. New York: Gardner, 1977.