**Abstract** The author's intellectual movement over the past two decades, from cross-cultural experimental psychology to the cultural psychology of mediation of human activities and cognitive processes, is described in this paper. Productive use of the concept of culture in psychology entails conceptualization of the future and the past in the present, and taking a process-based look at human activities. Cultural mediation in the case of reading is described. The emphasis on the emergent psychological processes as being culturally constituted leads to the need to explore novel paths in reconstructing psychology's methodology.

**Key Words** cross-cultural psychology, culture, mediation, methodology, reading

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# Culture and Cognitive Development: From Cross-cultural Research to Creating Systems of Cultural Mediation

My involvement in the study of culture and human psychological processes began 30 years ago when I was sent as a consultant to John Gay, then a missionary teacher of mathematics at a small college in the interior of Liberia, West Africa. The task: to figure out why Liberian children seemed to experience so much difficulty learning mathematics. My graduate training was in the tradition of American mathematical learning theory, which at that time entailed the use of algebra and probability theory to provide a foundation for discovery of presumably universal laws of learning. I knew almost nothing about the teaching and learning of mathematics, and even less about Liberia.

Although I began this experience with high hopes that experimental methods would prove successful in elaborating the cultural foundations of learning and development, by the end of the first decade of research I had acquired a healthy skepticism about the applicability of standard psychological, experimental procedures to elucidating cultural differences in learning and thinking. Over the past two decades

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my focus shifted first to an examination of the historical antecedents of the methodological problems I encountered, the search for a resolution of those problems, and, in this connection, a search for a more adequate theoretical foundation for understanding the role of culture in constituting human cognition.

A good deal of this work has been published and I do not attempt to summarize it here (Cole, 1988, 1990; Cole, Hood, & McDermott, 1978; Newman, Griffin, & Cole, 1989). Rather, I first provide some examples of research which motivated my concern about psychological methods and the attempts that my colleagues and I made to overcome them. My conclusion is that despite its surface attractiveness and important lessons that can be learned from it, there are difficulties inherent in the cross-cultural enterprise that limit its usefulness for explicating culture–cognition relationships. Turning from cross-cultural to what might be called a 'cultural-mediational' approach, I attempt to offer some theoretical ideas and methodological innovations that may contribute to understanding the role of culture in mind.

## The Cross-Cultural Approach to Development and its Limitations

A basic reorientation of thinking that occurred early in our work in Liberia was the conviction that an explication of the cultural foundations of thinking needed to begin from an analysis of what people do in their everyday lives. This led us to work with ethnographers and to attempt, insofar as possible, to build our methods upon local practices. We were particularly interested in cases where it appeared that local people seemed to show impressive abilities.

From our own experience in the field, as well as the anthropological literature, we knew that when urban-educated Americans and Europeans go to rural Africa they often experience difficulty learning to distinguish various plants that are well known to the local population, even the children. So severe can these difficulties be that native peoples respond with incredulity when European visitors display their woeful lack of discriminative powers (for a particularly vivid example, see Bowen, 1954, pp. 15–16). We decided to investigate this problem in a formal experiment (see Cole, Gay, Glick, and Sharp, 1971, for details).

Our subjects were 30 American and Canadian college students and Peace Corps volunteers living at or near the small college that was our base of operations and 30 non-literate rice farmers who were residents of the local area. Our materials were 14 leaves, seven from vines, seven from trees, that were indigenous to the area. Subjects from each of the

two population groups were assigned haphazardly to one of three experimental conditions. In the first condition the subjects were told that they would be shown leaves that were either from trees or from vines and they should say which leaves came from which source. In the second condition they were presented exactly the same set of leaves dichotomized in the same way but they were told that they would be shown leaves, some of which belonged to Sumo and some to Togba (two common local names) and they were to say which person the leaves belonged to. In the third condition, their instructions were the same as in the second condition, except that the leaves were assigned at random to names, so that the local categorization of leaves was irrelevant to the solution of the problem. Following each response, the correct classification was stated by the experimenter. Presentations continued until there were two errorless passes through the set of leaves.

The data are shown in Table 1. Two results stand out. First, on the average, the American/Canadian students required about nine presentations of the set to be able to identify all of the leaves correctly, regardless of the conditions of learning. Second, the rice farmers generally learned more rapidly, but the conditions of learning made an enormous difference. If they were told to identify leaves according to the categories of tree and vine, they performed almost errorlessly from the beginning. However, when asked to identify which items belonged to Sumo or Togba, they performed no better in the case where all the tree leaves belonged to Sumo and all the vine leaves to Togba than when the leaves were assigned at random with respect to category names (although still somewhat better than the American/Canadian group). They completely failed to use a categorial distinction that they certainly knew. In a follow-up to this study, we actually found cases where US college students were so focused on discovering categories in paired associate lists that they were greatly impeded in learning lists where obvious category members were not paired, whereas, again, the rice farmers were indifferent to latent category structure and hence learned such scrambled lists faster than the US students.

The second example has a quite different origin; it is a case where non-literate people were said to experience difficulties. It is also

*Table 1.* Number of complete presentations required to complete one correct identification of all leaves

| | Experimental Condition | | |
|---|---|---|---|
| | Tree–vine rule | Sumo–Togba rule | Sumo–Togba random |
| Liberians | 1.1 | 7.3 | 6.8 |
| Amer./Canad. | 8.9 | 9.8 | 9.0 |

relevant to my account because it is the starting-point for my interest in Russian cultural-historical approaches to culture and cognition. It concerns reasoning about logical syllogisms.

In recent years considerable evidence has been amassed to demonstrate that American college students fail to solve logical syllogisms unless they already possess rich knowledge of the content domain of the problem (D'Andrade, 1990). Still, the typical response of college students (or second graders, as shown by Orasanu and Scribner, 1982) is quite different from that of non-literate farmers in Liberia, Mexico (Sharp, Cole, & Lave, 1979), or Uzbekistan (Luria, 1976). The following example is typical of data we collected in many locales on many occasions.

*Experimenter* ... Spider and black deer always eat together. Spider is eating. Is black deer eating?
*Subject* Were they in the bush?
*Experimenter* Yes.
*Subject* They were eating together.
*Experimenter* Spider and black deer always eat together. Spider is eating. Is black deer eating?
*Subject* But I was not there. How can I answer such a question? (Cole et al., 1971, p. 187)

Several attempts have been made in the past 20 years to understand precisely how the differing developmental histories of the non-literate farmers produce these very different outcomes (see Laboratory of Comparative Human Cognition [LCHC], 1983, and Segall, Dasen Berry, & Poortinga, 1990, for relevant reviews; Tulviste, 1991). While much has been learned in the course of this empirical work, definitive explanations for such cultural differences remain elusive.

The problem is especially clear with respect to many studies of syllogistic reasoning in which we found that increases in sophistication of cognitive performances as a function of age occurred only if the subjects had attended school. The obvious conclusion is that there is something about schooling that promotes developmental, cognitive change in reasoning processes (Tulviste, 1991). However, there are at least two reasons to be very cautious about making such causal attributions.

First, as with any experiment involving naturally occurring groups, there is the possibility that selection factors are responsible for differential performance. Thus, for example, it might be argued that when schooling is taken as the independent variable differentiating different groups of Liberians from small farming communities, the initially brighter children went to school or stayed in school longer. Such selective effects can be assessed by using covariate techniques, and on

balance the evidence seems to indicate that it really is schooling, and not some selection factor, that leads to improved cognitive performance on syllogistic reasoning and a variety of learning tasks (see Rogoff, 1989, and Sharp, Cole, & Lave, 1979, for a discussion of this issue).

Second, as is often the case in cross-cultural work, replications of school/non-school comparisons in different societies are not completely consistent. While formal schooling involving the acquisition of literacy and the mastery of large amounts of esoteric information usually seems to play a major role in improving performance as children grow older, in some locales non-literate people seem to perform similarly to those who have attended school (Das, 1988).

Third, even in cases where schooling does bring about a marked change in performance, there is deep uncertainty about the generality of the mental changes wrought. When researchers have varied the contents and procedures of the particular tasks they use, it has often been found that presumably absent or underdeveloped skills reveal themselves (see LCHC, 1983, for a review). Even in cases where modifications of experimental procedures fail to evoke a particular kind of performance (as has generally been the case in syllogistic reasoning studies), the failure of non-literate people to use expected forms of deductive reasoning almost certainly does not indicate a generalized failure to use reasoning adequately as a part of their everyday problem-solving, since analysis of such everyday activities virtually demands the conclusion that such processes are in use (a point made with particular clarity by Jahoda, 1982).

The general difficulty in relying on the results derived from experimental paradigms routinely used by psychologists for industrialized countries is that insofar as the learning and problem-solving tasks used to assess cognitive processing derive from the structure and content of schooling, they are really mute with respect to cognitive processes in systems of activity organized for different purposes. The historical linkages between the structure of psychological tests and experimental procedures, on the one hand, and schooling, on the other, makes it logically indefensible to use such tasks as the basis of general comparisons on the relationship between different life histories and different patterns of intellectual development.

To be sure, we can study the organization of classroom practices to determine how their structure might induce children to accept the premises of a syllogism or to seek out potential categorial structure in an array of stimuli presented for remembering. In such work, the fact that there are fairly detailed models of the processing that generates various patterns of performance is useful. However, this narrowed

focus has the unfortunate property of restricting our analysis of the relationship between developmental history and thinking, the topic we were presumably interested in addressing.

Realization of the limitations of empirical cross-cultural research based on the cognitive-psychological paradigms which I learned to use during and immediately after my graduate career led me and my colleagues to a number of methodological investigations that, while not without interest, failed to get deeply into the question of the cultural mechanisms of developmental change which presumably lie at the heart of this line of inquiry (Cole, et al., 1978). As a consequence, in the past decade we have shifted our strategy; instead of focusing on cross-cultural variations in the products of developmental history my colleagues and I began to seek an understanding of the role of culture in the process of developmental change.

This shift from the study of products to that of processes has led to a substantial change in research strategy. In particular, instead of engaging in cross-cultural research, we began to focus on children in our own society and on the creation of special learning environments within which to study the processes of change. Following this line of approach led us to concentrate on understanding how efficient intellectual performance can be produced instead of starting from the study of 'differences in performance manifest at a particular time by individuals with varied and unknown learning histories' (Estes, 1976, p. 303). It has also forced us to consider more deeply what it is we mean by culture, the issue to which I now turn.

## Needed: A Psychologically Relevant Conception of Culture

First, a word of caution in dealing with the term 'culture'. As D'Andrade (1984) points out, competing definitions of culture are not, technically speaking, definitions (e.g. 'a paraphrase that maintains the truth or falsity of statements in a theory when substituted for the word defined'). Rather, competing definitions of culture are more like theories in that they seek to make substantive propositions about an aspect of the world. The 'definitions' one offers depend upon what kinds of propositions about what aspects of the world one is interested in. I am interested in a definition of culture that can be used to guide research and theory in the study of human development.

Super (1987) has noted that definitions of culture seem to vacillate between omnibus characterizations such as E.B. Tylor's early definition of culture as a complex 'which includes knowledge, belief, art,

morals, law, custom, and any other capabilities and habits acquired by man as a member of society' (1871, p. 1) and the presumably narrower notion that culture is a society's system of shared meanings (Geertz, 1973). Psychologists who seek 'the' correct definition within this set are certain to be disappointed. A well-known monograph by Kroeber and Kluckholn (1952), for example, offered more than 250 definitions and the number has certainly grown considerably since that time!

Since appeal to a 'generally accepted' (let alone 'the correct') definition is almost certainly a hopeless enterprise, I will take the alternative tack of adopting a conception of culture which can be considered respectable if not universally adopted by modern anthropologists and which affords deeper understanding of the relationship between culture, learning and development that I am seeking (see Shweder & LeVine, 1984, for an extensive discussion of this issue by anthropologists of varying persuasions, and Lave, 1988, for an anthropologist's view of the shortcomings of both anthropological and psychological approaches to the study of the relation between culture and psychological processes).

The conception of culture which my colleagues and I have been advocating can be approached from several directions. First we can note that the concept 'culture' occurs in the discipline of biology as well as in the social sciences. For example, we are accustomed to think of a 'tissue culture' as a special medium within which cells of the appropriate kind will proliferate. Culture, understood in this manner, can be considered the specifically human medium within which the sources of development that underpin traditional developmental theories (nature–nurture, biology–environment, individual–society) interact to produce development. (In this sense, as Valsiner [1989] has pointed out, culture cannot be considered an independent variable in the style of traditional cross-cultural research.)

## Culture as a Medium Constituted of Artifacts

Over the years my ideas about the role of culture in development have been significantly influenced by the writings of Russian psychologists associated with the cultural-historical school of L.S. Vygotsky, A.R. Luria, and A.N. Leontiev (see Cole, 1988, for a summary of my interpretation of this line of thought in relation to earlier cross-cultural work by myself and my colleagues). Central to their formulations (and a good deal of anthropological theorizing) is the notion that human beings are distinct from other creatures in that they live in an environment transformed by the artifacts of prior generations, extend-

ing back to the beginning of the species (Geertz, 1973; Ilyenkov, 1977; Sahlins, 1976, Wartofsky, 1979). The basic function of these artifacts is to coordinate human beings with the environment and each other.

According to this view, cultural artifacts are simultaneously ideal (conceptual) and material. They are ideal in that they contain in coded form the interactions of which they were previously a part and which they mediate in the present. They are material in that they exist only insofar as they are embodied in material artifacts. This principle applies with equal force whether one is considering language/speech or the more usually noted forms of artifacts which constitute material culture. The American anthropologist, Leslie White (1959), expressed the relationship as follows:

> An axe has a subjective component; it would be meaningless without a concept and an attitude. On the other hand, a concept or attitude would be meaningless without overt expression, in behavior or speech (which is a form of behavior). Every cultural element, every cultural trait, therefore, has a subjective and an objective aspect. (p. 236)

The special characteristics of human mental life are precisely those characteristics of an organism that can inhabit, transform and recreate an artifact-mediated world. As Soviet philosopher Evald Ilyenkov (1977) put it, 'the world of things created by man for man, and therefore, things whose forms are reified forms of human activity ... is the condition for the existence of human consciousness' (p. 94). The special nature of this consciousness follows from the dual material/ideal nature of the systems of artifacts that constitute the cultural environment—human beings live in a 'double world', simultaneously 'natural' and 'artificial'.

The characteristics of human psychological processes that accompany the view that human nature is created in culture-as-historically-accumulated-systems-of-artifacts was described in particularly powerful language by White (1942), who wrote:

> Man differs from the apes, and indeed all other living creatures so far as we know, in that he is capable of symbolic behavior. With words man creates a new world, a world of ideas and philosophies. In this world man lives just as truly as in the physical world of his senses. ... This world comes to have a continuity and a permanence that the external world of the senses can never have. It is not made up of present only but of a past and a future as well. Temporally, it is not a succession of disconnected episodes, but a continuum extending to infinity in both directions, from eternity to eternity. (p. 372)

(See Luria, 1981, for an exploration of further implications of this view.) This basic perspective is often represented as a triangle, in which the vertex is a mediating artifact and the remaining points are

subject and object (see Figure 1). (For an early statement of this perspective containing such a triangle, see Vygotsky, 1929). In such a representation, the 'first' world is conceived of as the 'direct' link between subject and object, while the 'second' world is given by the indirect pathway through the mediator, the structure of which is continuously being modified by its participation in the patterned forms of activity embodied in culture. In addition, the Russian cultural-historical theorists emphasized that mediators (artifacts) enter into the organization of behavior in two ways that complement their conceptual/material nature. They act simultaneously as tool and constraint; in coming to master aspects of the world, children come to master themselves (Luria, 1976; Vygotsky, 1978).

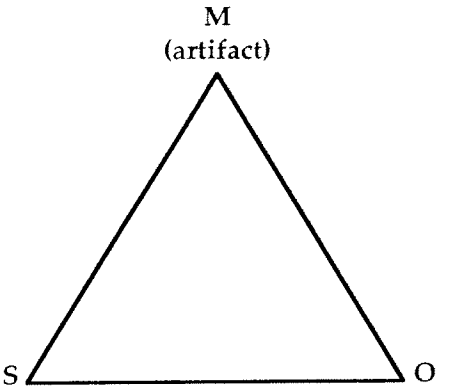


*Figure 1.* The basic mediational triangle in which subject (S) and object (O) are seen not only as 'directly' connected, but simultaneously 'indirectly' connected through a medium (M) constituted of artifacts.

While the static image of a triangle providing direct and indirect sources of knowledge represents the dual sources of knowledge, it underrepresents the fact that only at rare moments do the 'culturally' given and the 'directly' given coincide completely to determine the 'behaviorally taken'. Hence my colleagues and I like to draw the basic mediational triangle as in Figure 2. This figure emphasizes the dual nature of culturally mediated activity and the ineluctable discrepancies between competing sources of knowledge requiring a constant, active process of synthesis out of which a new state of knowledge emerges. It also puts time into the unit of analysis.

This basic triangular schema, while representing minimal structural constraints on adult cognition, needs to be supplemented in elaborating the cultural constitution of development. First, since it represents

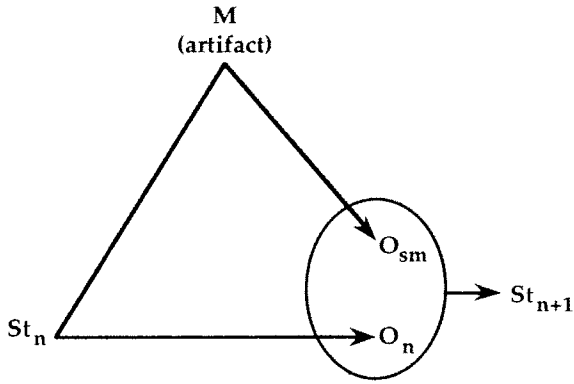


*Figure 2.* The closed system of Figure 1 is replaced by an open system in which the state of the subject–object relation at time n (Stn – On) must be coordinated with the information in the S–M–O link of the triangle (Osm), out of which emerges the state of the organism at time n + 1 (Stn + 1).

adult consciousness, not that of a newborn, we have to understand how it develops. Second, while artifact creation and artifact mediation are central to culture, culture is not a random assemblage of such artifacts. 'It is through culture patterns, ordered clusters of significant symbols, that man makes sense of the events through which he lives' (Geertz, 1973, p. 363). Third, artifact mediation always occurs as part of a larger unit of social-cultural structuration referred to as context, situation, practice, activity, etc.

Hence it is essential to say something about the matter of the structuring of artifacts if one is to elaborate a cultural theory of development. This is an extremely complex topic which space does not permit me to pursue in detail (see Cole, 1994). For my present purposes I will draw upon a notion of culture that is embedded deeply in anglophone cultural heritage.

## The Garden Metaphor for Culture

As Raymond Williams has remarked, culture is one of the most complex concepts in the English language. Its roots can be traced back through Old English to Latin. The core features which coalesce in modern conceptions of culture refer to the process of helping things to grow. 'Culture', Williams (1973) wrote, 'in all of its early uses was a noun of process: the tending of something, basically crops or animals' (p. 87). Sometime around the 16th century, culture began to refer to the tending of human children, in addition to crops and animals.

From the beginning, the core idea of culture as a process of helping

things to grow was combined with a general theory for how to promote growth: create an artificial environment where young organisms could be provided optimal conditions for growth. Such tending required tools, of course, and it is somehow provocative to learn that one of the early meanings of culture was 'plowshare'.

Although it would be foolish to overinterpret the metaphorical parallels between the theory and practice of growing next generations of crops and next generations of children, the exercise, I argue, has considerable heuristic value. Broadly speaking, gardeners must attend simultaneously to two classes of concerns: what transpires inside the garden and what transpires around it. These issues often seem to be addressable independently of each other, but in reality are interdependent. Inside the garden, for every kind of plant, one must consider the quality of the soil, the best way to till the soil, the kinds of nutrients to use, the right amount of moisture, as well as the best time to plant and nurture the seeds, and the need to protect the growing plants against predators, disease, etc. Each of these tasks has its own material needs, associated tools and knowledge. The theory and practice of development at this level focuses on finding exactly the right combination of factors to promote life within the garden walls.

Gardens do not, obviously, exist independently of the larger ecological system within which they are embedded. While it is possible to raise any plant anywhere in the world, given the opportunity first to arrange the appropriate set of conditions, it is not always possible to create the right conditions, even for a short while. And if what one is interested in is more than a short-run demonstration of the possibility of creating a development-promoting system, but rather the creation of conditions which sustain the needed properties of the artificial environment without unsustainable additional labor, then it is as important to attend to the system in which the garden is embedded as the properties of the 'garden itself'.

## Applying the Concept of Culture

The utility of thinking about culture as a medium constituted of historically cumulated artifacts which are organized to accomplish human growth must be demonstrated by its ability to help us understand the processes of learning and development. In the sections that follow I offer two examples of the way that I apply this way of thinking about culture and development: one derived from observations made by an eminent pediatrician and one from my own work. The first is selected from a natural observation of a baby being born; I have chosen

it because it illustrates the non-linear temporality of culture, one of its least understood aspects, in a particularly clear way. The second example is an application of the idea of culture-medium to a familiar practical problem in human mediated activity, reading.

**Bringing the Future into the Present**

One of the great puzzles in the study of development is what controls the sequences of forms and functions that characterize the growing organism over time. With respect to biological development, we know that as the cells in the zygote begin to multiply they also begin to take on a variety of forms; we explain the fact that certain cells become bone while others become nervous tissue by invoking the notion that interactions between the cells and their prenatal environment (including other cells) is constrained by a genetic code. Crudely speaking, future forms are (at least potentially) present at birth in the genetic material contained in the zygote (Lewontin, 1982). Cultural constraints are not contained in biological form, but rather are embodied in the material/ideal, patterned, artifacts that mediate the life of the community. In the case of both biological and cultural constraints, of course, the 'final cause' or 'telos' is only an 'if all other things are equal' final cause. The actual process of development is one of probabilistic, not predetermined, epigenesis (Gottlieb, 1992).

There is no secret about the sense in which cultural constraints exist in children's futures; they are born into a culturally structured world. But this does not explain how the palpable cultural constraints in place in adulthood are transformed 'backwards' into palpable material/physical constraints at birth. This process is called prolepsis.

The dictionary meaning of prolepsis is 'the representation of a future act or development as being presently existing' (*Webster's Dictionary*). This representation is experienced not as a biological code, but as the material/ideal, patterned, artifacts that mediate the life of the community. Success is not determined ahead of time in either cultural or biological evolution.

In recent years we have seen some interesting suggestions about the role of prolepsis in the organization of human psychological functions. Ragnar Rommetveit (1974) uses the concept to explain communication (e.g. how human interaction results in sharing of meaning). Through prolepsis, Rommetveit writes, 'What is said serves ... to induce presuppositions and trigger anticipatory comprehension, and what is made known will hence necessarily transcend what is said' (p. 88). Stone and Wertsch (1984) use prolepsis to characterize the way in which teachers seek to induce children's understanding of how to

complete cognitive tasks; in effect, the teachers presuppose (at least hypothetically) that the children understand what it is they are trying to teach as a precondition for creating that understanding. Most recently, Barbara Rogoff and her colleagues (1994) made similar arguments with respect to the development of the ability to plan.

The uniquely human form of development resulting from prolepsis is beautifully illustrated by the work of pediatrician Aiden Macfarlane (1977), who published several transcripts of the reactions of parents when they first catch sight of their newborn child and discover its sex. Typical examples include such comments as 'I shall be worried to death when she's 18' or ' It can't play rugby' (said of another girl). In each of these examples, the adults interpret the biological characteristics of the child in terms of their own past (cultural) experience. In the experience of English men and women living in the mid-20th century it could be considered 'common knowledge' that girls do not play rugby and that when they enter adolescence they will be the object of boys' sexual attention, putting them at various kinds of risk. Using this information derived from their cultural past and assuming that the world will be very much for their daughter as it has been for them, they project a probable future for the child (recall White's notion of culture providing continuity from 'infinity to infinity'): she will be sought after by males as a sexual partner, thus causing them anxiety; she will not participate in a form of activity (rugby) requiring strength and agility that is the special preserve of males, etc.

Of crucial importance to understanding the contribution of culture in constituting development is the fact that the parents' projection of their children's future becomes a fundamentally important material/cultural constraint organizing the child's life experiences in the present, because, as copious research has demonstrated, even adults totally ignorant of the real gender of a newborn will treat it quite differently depending upon its symbolic/cultural 'gender'. Adults confronted with babies in blue or pink diapers (assigned at random with respect to sex) literally create different material forms of interaction based on conceptions of the world provided by their cultural experience. For example, they bounce 'boy' infants (those wearing blue diapers) and attribute 'manly' virtues to them while they treat 'girl' infants (those wearing pink diapers) in a gentle manner and attribute 'feminine' attributes to them (Rubin, Provezano, & Luria, 1974). Macfarlane's simple example also motivates the special emphasis placed on the social origins of higher psychological functions by cultural psychologists (Cole, 1988; Rogoff, 1989, Vygotsky, 1978; Wertsch, 1985). These points are best illustrated by referring to Figures 3(a) and 3(b).

Figure 3 presents five time lines, the bottom four of which correspond to the three 'developmental domains' (Wertsch, 1985) that, according to the cultural-mediational framework espoused here, simultaneously serve as major constraints for human development. At the top of the figure is what might be called 'physical time', or the history of the universe that long precedes the appearance of life on earth. The second line represents phylogenetic time, the history of life on earth. The third represents cultural-historical time, which co-evolved with phylogenetic time. The fourth line represents ontogeny, the history of a single human being, and the fifth line represents the moment-to-moment time of lived human experience. The ellipse transecting these lines represents the events surrounding the baby in Macfarlane's observations. There are therefore four kinds of genesis: phylogenesis, culturogenesis, ontogenesis and microgenesis, each 'lower' level embedded in the level 'above it'. What Macfarlane's example urges upon us is the need to keep in mind that not one but two ontogenies must be represented in place of the single ontogeny in

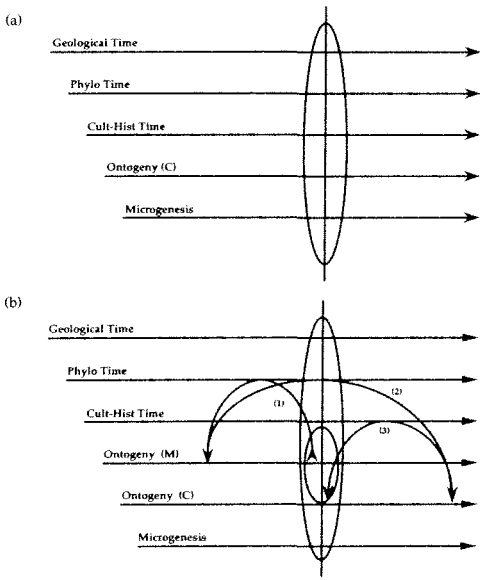


*Figure 3.(a)* Different time scales simultaneously operative in the organization of human development. The ellipse indicates the context of the birth of a child.
(b) Different time scales with ontogeny of the mother added and arrows indicating the cultural origins and social organization of the child's context at birth. The entire cycle from past to future and back to the present is needed to understand cultural constraints on development.
*Key.* Phylo = phylogenetic; Cult-Hist = cultural-historical.

Figure 3(a). That is, at a minimum one needs a mother and a child for the process of birth to occur and for development to proceed. These two ontogenies are coordinated in time by the simultaneous structuration provided by phylogeny and culture (Figure 3(b)). This process is depicted in Figure 3(b) by following the arrows from the mother→(remembered) cultural past of the mother→(imagined) cultural future of the baby→present adult treatment of the baby.

As Macfarlane's transcripts clearly demonstrate, human nature is social in a sense different from the sociability of other species because only a culture-using human being can 'reach into' the cultural past, project that remembered past imaginatively into the future, and then 'carry' that (purely conceptual) future 'back' into the present in the shape of beliefs which then constrain and organize the present sociocultural environment of the newcomer.

**Remediating Reading Failure**

It is a very large jump indeed from the birth of a baby to the initiation of a process called 'learning to read'. However, I want to suggest that many of the same mechanisms involved when parents create a future in the present for the newborn can be invoked as a way of understanding and guiding the process of learning to read. For example, the adults who arrange the environments of reading, like the mother with her newborn, arrange the current circumstances of the child in terms of expectations about the child's future. They also of course, draw on their own culturally organized prior experience in deciding how to behave.

In moving from observation of an event organized by medical practices to an experimental intervention organized specifically to promote a particular kind of cognitive development I want self-consciously to emphasize the way in which we make use of the garden metaphor and the mechanism of prolepsis in arranging the environment for growth of the children's reading ability and I also want to make the (perhaps outrageous) suggestion that our procedures are a form of artificial intelligence. The relevance of the garden metaphor will become clearer as the exposition proceeds. But a few words are in order about the notion of artificial.

In his classic discussion of sciences of the artificial, Herbert Simon (1969) gives four criteria that distinguish the artificial from the natural, providing boundaries on the sciences of the artificial:

1. Artificial things are synthesized ...
2. Artificial things may imitate appearances in natural things while lacking, in one or many respects, the reality of the latter.

3. Artificial things can be characterized in terms of functions, goals and adaptation.
4. Artificial things are often discussed, particularly when they are being designed, in terms of imperatives as well as descriptives. (pp. 5–6)

In the work to be described here, the artifical thing in question is a somewhat unusual form of group reading activity called 'Question-Asking-Reading'. It is synthesized out of a variety of elements, it involves imitation of mature forms of reading by children who are often lacking aspects of the behavior it is modelled on, it is clearly intended to be goal oriented in several respects and there are strong imperatives associated with it. The subjects were children for whom the usual instructional process (guided by theories of learning and development that are not consistent with the notion of culture that I have been promoting) had failed. They had been attending school for three or more years and could not comprehend text, although most of them have developed some skill at providing oral versions of written words. This failure was sufficient to have them classified as learning or reading disabled and to induce their teachers to send them to our special afterschool activities in the hopes that we could remedy a situation they see as bad for the child.

*Theories of Reading Acquisition*

There is broad agreement that reading is 'a complex skill requiring the coordination of a number of interrelated sources of information' (Anderson, Hiebert, Scott, & Wilkinson, 1985), and a great deal is known about the processes involved for those who have acquired some degree of skill. But despite intensive research efforts throughout this century, and especially over the past two decades, the process of acquisition remains disputed (see Crowder & Wagner, 1992, for a discussion of conflicting views). The problem is an important one because at present a great many children of normal intelligence fail to acquire reading skills deemed adequate for productive participation in modern societies (Miller, 1988).

Despite significant differences among them, modern approaches to reading have distinguished two, major, presumably distinct, components of the reading process: decoding (the process by which letters of the alphabet are associated with corresponding acoustic patterns) and comprehension (the process by which meaning is assigned to resulting visual/acoustic representation). Within this dichotomy, theorists differ on the question of how to sequence instruction (code emphasis first vs meaning emphasis first) and how best to help children 'break the code' (by teaching phonetic analysis or by teaching whole words) (Chall, 1983).

An example of the 'code emphasis first' approach can be found in the work of Jean Chall (1983), who proposes the following stage theory of reading development (I concentrate here on the early stages):

Stage 0 Prereading. Children at this stage may pretend to read and know some letter names

Stage 1 Decoding. The basic task of Stage 1 is to learn the arbitrary set of letter in the alphabet and to decode their correspondence to the sounds of spoken language.

Stage 2 Confirmation, fluency, ungluing from print. New readers confirm and solidify the gains of the previous stage. To avoid confusion, they are given familiar texts which do not demand much mental effort to comprehend.

Stage 3 Reading for learning something new. Instead of relating print to speech, children now are asked to relate print to ideas. It is only at this stage, writes Chall, that 'reading begins to compete with other means of knowing'. In the two remaining stages, children elaborate their comprehension skills, learning to juxtapose facts and theories, and to construct complex ideas with the help of print.

Goodman and Goodman (1979) start from the assumption that children living in a literate society arrive at school with the rudiments of reading-as-comprehending-the-world-through-print already in their repertoires; for example, children can read various road signs, pick out the McDonald's sign, and perhaps recognize their own names in print. Their model of acquisition is non-developmental in the sense that acquisition does not entail the emergence of any new process or the reorganization of old ones. All they need to do from the beginning is to expand the repertoire of functions that they can accomplish with the aid of print. This expansion process occurs naturally with the accretion of experiences in comprehending the world through print. Consequently, mastery of the code goes hand in hand with expanding the functions to which reading is put.

### *A Cultural-mediational Model*

Like Chall, we believe that reading is a developmental process and that the goal of reading instruction is to provide means for children to reorganize their interpretative activity using print. Like the Goodmans, we believe that reading text is an elaboration of the pre-existing ability to 'read the world' using signs of various kinds. Our own approach is distinctive in its simultaneous emphasis on three interrelated points.

First, we believe that reading instruction must emphasize both decoding and comprehension in a single, integrated activity—an assumption that can be interpreted in terms of the idea that reading requires the coordination of 'bottom up' (feature→ letter→ word→ phrase→ ...) and 'top down' (knowledge-based, comprehension-

driven processes out of which new schemata emerge (McClelland & Rumelhart, 1981). Second, we believe that under ordinary circumstances adults play an essential role in coordinating children's activity such that the development of reading becomes possible. Third, we believe that successful adult efforts depend crucially on their organizing a 'cultural medium for reading' which has the properties of culture that I have been emphasizing here: it must use artifacts (most notably, but not only, the text) and orchestrated social relations to coordinate the child with the to-be-acquired system of mediation even before s/he can read to make possible the desired developmental achievement.

As a starting-point for our analysis, we begin by modifying slightly the common-sense definition of reading. Reading, in a cultural-psychological perspective, is the process of expanding the ability to mediate one's interactions with the environment by interpreting print. There are two significant aspects of this definition. First, learning to read and proficient reading are both subsumed in the same definition. What one learns to do is expand; what one does, having learned, is to continue expanding (see Engeström, 1987, for a general discussion of 'learning by expanding'). Second, there is no dichotomy between decoding and comprehension since comprehension is understood as the process of mediating one's interactions with the environment, including text processing (interpreting letter groups) as a condition.

Figure 4, which repeats the structure of Figure 1, but with text substituted for artifact, reminds us that reading, in the broadest sense, requires the coordination of information from 'two routes'. Any reader must 'see' the world as refracted through a text; but in order to do so, the reader's more direct access to the world (prior knowledge),

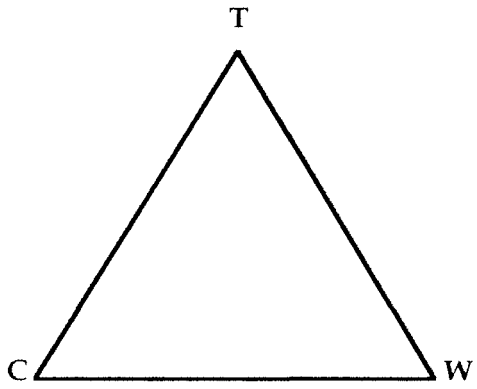


*Figure 4.* The basic mediational triangle, with text as the mediating artifact.
*Key.* C = child; T = text; W = world.

topicalized by the text, must be simultaneously engaged. As was true in the case of the general discussion of mediation earlier in this paper, the mediational process depicted in Figure 4 is a timeless ideal. Even among skilled readers, the act of coordinating the two routes may require adjustments in the representation of the 'worlds' arrived at by either route to permit a new representation (expanded understanding) to emerge. The slight discoordination depicted in Figure 5 (a specialized version of Figure 2) more accurately reflects the dynamic process that we have in mind.

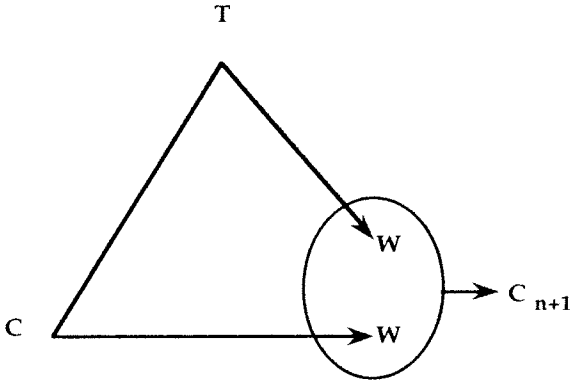


*Figure 5.* The basic mediational triangle as an open system.
*Key.* C = child; T = text; W = world; $C_{n+1}$ = child at time n + 1.

With this minimal structural apparatus in hand, we can now turn to the crucial question: Assuming that children do not enter school already able to read, that is, expand their ability to comprehend by interpreting the world through alphabetic text, how can we arrange for them to develop this ability? In attempting to answer this question, we simultaneously tackle the crucial question of how is it possible to acquire a more powerful cognitive structure unless, in some sense, it is already present to begin with? This question, called the 'paradox of development' by Fodor (1983) and the 'learning paradox' by Bereiter, calls into doubt any developmental account of reading that fails to specify the pre-existing constraints that make development possible. Bringing the end-point 'forward' to the beginning is not less relevant in developing the ability to read than in any other developmental process.

From our perspective, developmental theories of reading such as Chall's are vulnerable to the learning paradox. Since we share with her a belief that the acquisition of reading is a developmental process requiring a qualitative reorganization of behavior, we must begin by

showing in what sense the endpoint of development, the ability to mediate one's comprehension of the world through print, could in principle be shown to be present in embryonic form at the outset of instruction. The solution to this problem, following the principles of cultural psychology, is to invoke Vygotsky's (1978) 'general genetic law of cultural development': functions that initially appear on the interpsychological plane shared between people can then become intra-psychological functions of the individual. In this case, what we seek is the structural endpoint of mature reading in the interaction between child and adult as a precondition for this new structure of activity to appear as an individual psychological function in the child.

Figure 6 displays in graphic form the fact that at the beginning of instruction there are two pre-existing mediational systems which can be used as resources for creating the necessary structural constraints to permit the development of reading in the child. At the far left of the figure we represent the common-sense fact that children enter reading instruction with years of experience mediating their interactions through the world via adults. In the center we represent the equally common-sense fact that literate adults routinely mediate their interactions through text. Finally, on the far right of the figure is the to-be-developed system of mediation that is our target.

Figure 7 shows the next stage in the analytic/instructional strategy: the given and to-be-developed systems of child mediations are juxtaposed and the given adult system is then superimposed, to reveal the skeletal structure of an 'interpsychological' system of mediation that, indirectly, establishes dual system of mediation for the child, which permits the coordination of text-based and prior-world-knowledge-based information of the kind involved in the whole act of reading.

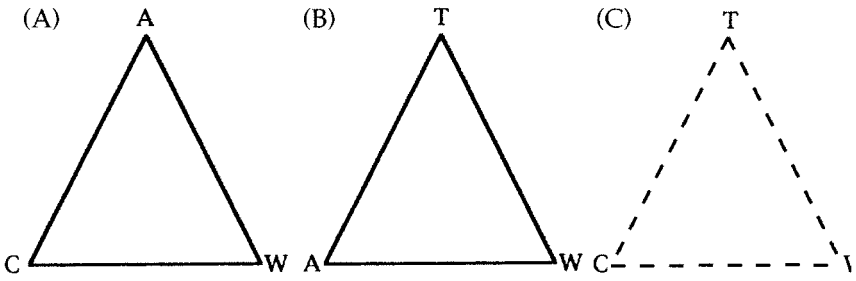


*Figure 6.* Given and to-be-developed mediations required for reading as an independent activity. (A) the previously existing mediational structure in which children mediate their activity via adults; (B) the previously existing ability of adults to mediate their actions in the world via print; (C) the to-be developed system of mediation whereby the child mediates actions through print.
*Key.* A = adult; C = child; W = world; T = text.

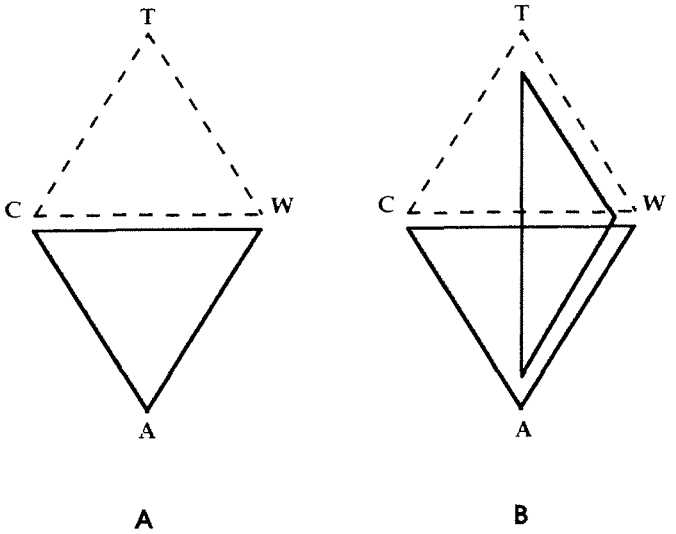


*Figure 7.* The given and to-be-developed systems are juxtaposed to show how they must be coordinated in order for the child's actions to come under the constraints of the whole act of reading before he or she is able to read independently.
*Key.* C = child; T = text; W = world.

### *Creating the Medium*

The instructional/developmental task is now better specified: we must somehow create a system of interpersonal interaction such that the combined child–adult system at the right of Figure 7 can coordinate the child's act of reading before the child can accomplish this activity for him/herself. Our strategy for accomplishing this goal was a modification of the reciprocal teaching procedure of Palinscar and Brown (1984), in which teacher and student silently read a passage of text and then engage in a dialogue about it that includes summarizing the text, clarifying comprehension problems that arise, asking a question about the main idea and predicting the next part of the text. For a number of reasons (see LCHC, 1982, for additional details), our modification of reciprocal teaching was instantiated as a small group reading activity with 3rd- to 6th-grade children identified by their teachers as experiencing extraordinary difficulties learning to read.

The core elements of the procedure is a set of roles (each corresponding to a different hypothetical part of the whole act of reading) and each printed on 3" × 5" index cards. Every participant is responsible for fulfilling at least one role in the full activity of question-asking-reading. These cards specify the following roles:

- The person who asks about words that are hard to say.
- The person who asks about words that are hard to understand.
- The person who says what the main idea is.
- The person who picks the person to answer questions asked by others.
- The person who asks about what is going to happen next.

All participants, including the instructor, had a copy of the text to read, paper and pencil to jot down words, phrases or notes (in order to answer questions implicit in the roles), and their card, to remind them of their role. In light of the general principles of cultural mediation, we consider the role cards and the script within which they were sequenced to be cultural artifacts that could be used by the adults to create a structured medium for the development of reading. In order to move from the script to an appropriate medium of development, the procedural script was embedded in a more complex activity structure designed to make salient both the short-term and long-term goals of reading and to provide a means of coordinating around the script. It is in this embedding process that we make the transition from a focus on the structural model of reading depicted in Figures 5–7 to a focus on the necessary transformation of the mediational structure of the child's interactions with print.

Recognizing the need to create a medium rich in goals that could be resources for organizing the transition from reading as a guided activity to independent, voluntary reading, we saturated the environment with talk and activities about growing-up and the role of reading in a grown-up's life. This entire activity was conducted after school in a global activity structure we called 'Field Growing Up College' (it took place in the auditorium of the Field Elementary School). As part of their application to participate in Field College, of which question-asking-reading was a major activity, the children filled out applications that emphasized the relationship between reading and growing up. They got involved with us in discussions about the difference between growing older and growing up as well as how our activities related to their goal of growing up. In this way we made the future part of the present interactions.

As shown in Figure 8, question-asking-reading began each session with such 'goal talk', discussion about the various reasons that children might have for wanting to learn to read. These included such poorly understood reasons (from the children's point of view) as the need to read in order to obtain an attractive job such as becoming an astronaut, intermediate-level goals such as graduating from question-asking-reading to assist adults with computer-based instruction, to quite proximate goals—the desirability of getting correct answer on the quiz that came at the end of each reading session.

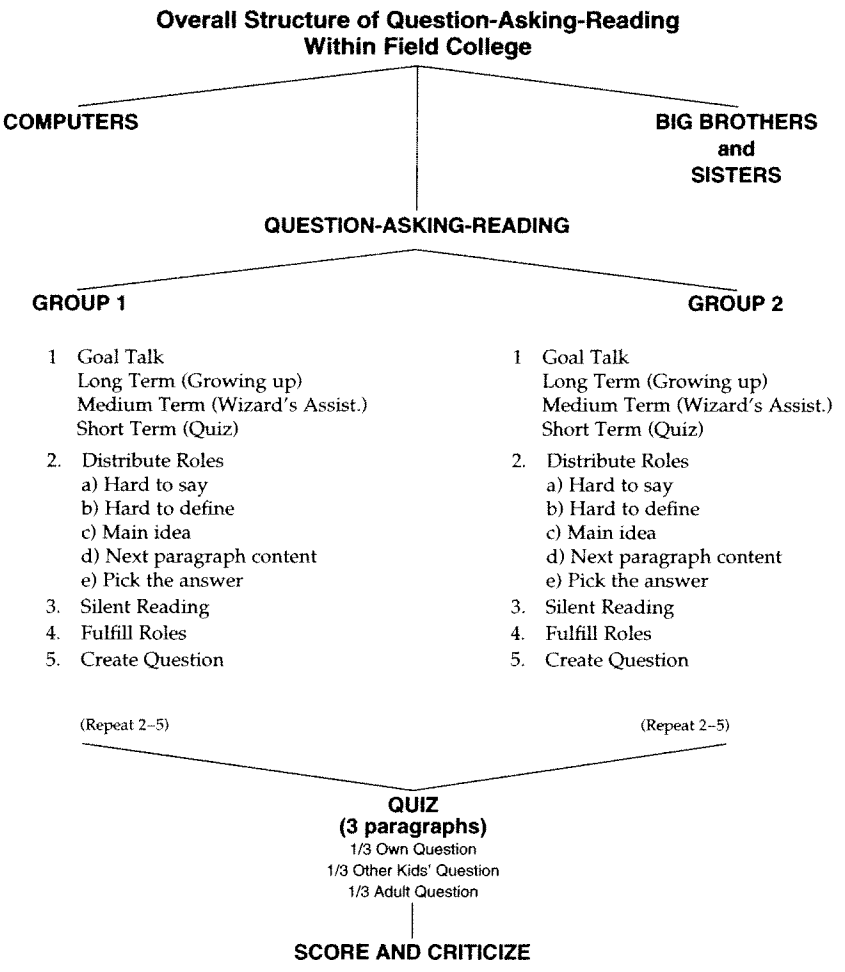


*Figure 8.* 'Field Growing Up College'.

Joint work with the text began with a group discussion of the title or headline of the story to be read that day. Then, following the script outline written in Figure 8, which was written on the blackboard, the role-bearing cards and the first paragraph of the text were passed around. A good deal of discussion usually ensued about who had gotten what roles; 'pick the answerer' was an obvious favorite, while the card implicating the main idea was avoided like the plague. Once the role cards were distributed, the text for the day (usually taken from local newspapers with content that related to matters of

potential interest to the children) was distributed, one paragraph at a time. The participants (including the instructor and one competent reader, usually a University of California at San Diego [UCSD] undergraduate, and the children) then bent over their passages to engage in silent reading.

These and other procedural arrangements constituted our attempt to organize a medium which would repeatedly create moments when the three mediational triangles depicted in Figure 7 would be coordinated to create the conditions for 're'-mediating the children's entering systems of mediation.

*The Data*

Our evidence for the way in which this procedure worked is derived from several sources: videotaped recordings of the instructional sessions; the children's written work on the quizzes that completed each session; and various test results. Here we will concentrate on the in situ process of coordination and discoordination around the scripted activity as a key source of evidence about individual children's ability to internalize the scripted roles and the points where internalization fails, resulting in selective discoordinations of the ongoing activity structure. In this example, two children, both of whom are failing in their reading classes, differentially discoordinate with the publicly available scripted activity, permitting differential diagnosis of their specific difficulties.

In the transcripts that follow, the two boys, Billy and Armandito, are starting to read the second paragraph of the day. Katie is their teacher and Larry is an additional competent reader. Evidence for internalization of the scripted activity is provided by instances in which the children's talk and actions presuppose a next step in the procedure with no overt provocation from the adults. For example:

| | | |
|---|---|---|
| (1) | *Katie* | OK, lets go on to the second paragraph then. |
| (2) | *Billy* | How did they find them? |
| (3) | *Armandito* | The Eskimos. |
| (4) | *Katie* | I think it was an accident [as she says this, she begins to pass out the role cards, face down]. |
| (5) | *Billy* | [Taking a card from the stack]. How come, what kind of accident? |
| (6) | *Billy* | [Looking at his card]. That's the same card again. |

In (2) Billy's question is an internalized version of the 'what's going to happen next?' role in the script that no one specifically stimulated. He takes the card handed to him, asks a relevant question about the text, and comments on the relationship between his role in the

previous segment of interaction and its relationship to what he is about to do. Armandito's participation is of a different order. His comment ('The Eskimos') is relevant to the topic at hand, but opaque. He does not take one of the role cards and has to be stimulated by Katie while Billy continues to show evidence of coordination:

(6) *Katie* Armandito! [He looks up and takes a card]
(7) *Billy* We each get another one [referring to the cards]; there are only four participants and Katie has not taken one, so someone will get an extra.

In a number of places in the transcript we see Armandito discoordinating within the activity which the other three participants maintain, permitting him to re-coordinate from time to time. These discoordinations are of several types. The most obvious are such actions as drawing a picture instead of reading, or feigning abandonment of the activity altogether. But repeatedly, Armandito presupposes the scripted activity sufficiently to motivate quite specific analyses of his difficulties. The next example illustrates his aversion to the question about the main idea and provides information (corroborated in many examples) of his core difficulty.

(8) *Larry* [He has the card which says to pick the answerer]. Armandito. What's the main idea?
(9) *Armandito* I want to ask mine. I want to ask what happens next.
(10) *Larry* No. I know what you want, but I am asking. I pick the answerer.
(11) *Armandito* The main idea is ... how these guys live.

Armandito is both accepting the joint task of question-asking-reading ('I want to ask mine') and attempting to avoid the role that is at the heart of his problem (figuring out the main idea) by skipping that part of the scripted sequence. When Armandito accepts his role (11) and attempts to state the main idea, his answer (' The main idea is ... how these guys live') is not only vague, it is about the previous paragraph.

Through an accumulation of many such examples over several sessions, we were able to obtain a consistent pattern. This pattern showed that Billy experienced great difficulty in coming 'unglued' from the letter–sound correspondences when he attempted to arrive at the main idea. When asked about the main idea, he repeatedly returned to the text and sought a 'copy match' in which some word from the question appeared in the text. He then read the relevant sentence aloud, and puzzled over meaning. Armandito's problem was of a quite different order: he continually lost track of the relevant

context, importing information from his classroom activities that day or previous reading passages which had no relevance.

The first conclusion that we want to draw from this exercise is that we were in fact successful in creating a structured medium of activity which allowed diagnostically useful information about which part of the structure depicted in Figure 7 was deficient in the children with whom we worked. However, we also wanted to establish that the question-asking-reading procedure is an effective procedure for the acquisition of reading. Both Billy and Armandito did in fact improve their reading abilities and Armandito's general behavior in the classroom changed so markedly that he won an award from the school recognizing his unusual progress. However, such individual change could not be attributed to question-asking-reading, both because it was part of the larger activity system of Field College and because we had no proper control group.

To remedy these shortcomings, King (1988) replicated the small group reading procedures in a follow-up experiment that included appropriate control conditions, more stringently quantified pre- and post-test measures, and was conducted as the sole activity in a school prior to the start of regular classes.

In addition to testing the effectiveness of question-asking-reading against a no-treatment control group, King included a group of children who were provided the kind of structured intervention that Scardamalia and Bereiter (1985) call 'procedural facilitation' to assess whether the dynamic, dialogic characteristics of question-asking-reading were any more effective than workbook exercises in which children completed each of the tasks corresponding to the role cards individually in written form. The children in this experiment, like those in the original work illustrated in the transcript fragment, were selected from the upper elementary grades owing to their difficulties in learning to read.

King found that both question-asking-reading and her version of the procedural facilitation technique boosted children's reading performance. However, children in the question-asking-reading group retained significantly more material from the training passages than did the students in the Procedural Facilitation group. The students in the question-asking-reading group also spent more total time actively engaged with the task and demonstrated a greater interest in the content of the readings, indicating an intimate link between the motivational, social-interactional and cognitive aspects of activity-in-context.

These results, although sketchily presented here owing to limita-

tions on space, provide support for the approach to reading we have developed in this chapter. Reading, we can conclude, is an emergent process of meaning-making that occurs when information topicalized by the text is synthesized with prior knowledge as part of a general process of mediated interaction with the world. Moreover, it is useful to conceive of the process of acquisition as developmental in nature. Where this process differs from other developmental approaches to reading acquisition is in its emphasis on the special role of the teacher in arranging the medium that coordinates pre-existing systems of mediation in a single system of activity subordinated to the goal of comprehension.

## Some Concluding Remarks

In this paper I have attempted to sketch the evolution of a research program that has sought a deeper understanding of the way in which culture enters into the development of human thought. We began with theoretical tools and methods derived from mid-20th-century American learning theories. Despite some success in identifying sources of population differences in performance on our tasks, it was not long before we concluded that simple hard work applying existing theories and methods might well prove inadequate. The very fact that Liberian rice farmers undergo such a different course of experience than (say) American office workers (the raison d'être of cross-cultural research) is the source of serious barriers to the use of the familiar apparatus of American experimental psychology.

The mode of research which developed from this experience begins with an analysis of the way in which human thinking occurs within culturally organized forms of activity. Experiments, from this perspective, become models of thinking-in-activity, the morphology of which is shaped by the cultural artifacts that mediate action. This new focus highlights the study of culture as a process of helping things grow and especially a property of cultural mediation that is generally absent from the models of learning that dominated my earlier thinking: cultural mediation is a mechanism through which the potential future child experiences (such as a newborn playing rugby 18 years hence or a child learning to read). In pursuing this new theoretical/methodological path, the tool kit of the psychologist is enlarged to include the analysis of discourse, the use of fieldnotes and videotapes to document thinking-in-situ, and attention to the way in which individual's responses fit into the activity that they help to constitute.

At present I am exploring the potential of designing small cultural

systems within which we investigate the practical significance of our theoretical claims about cultural mediation and methods for its study. One such example is the work on creating new forms of reading activity. Another is work on creating sustainable systems of after-school activity using computers and computer networks as key mediating artifacts (Nicolopolou & Cole, 1993). It is my hope that this work will provide a more productive way to integrate the insights of psychologists and anthropologists in the study of culture and mind.

## References


Anderson, R.C., Hiebert, E.H., Scott, J.A., & Wilkinson, I.A.G. (1985). *Becoming a nation of readers.* Washington, DC: National Institute of Education.

Bereiter, C. (1985). Toward a solution of the learning paradox. *Review of Educational Research,* 55, 201–226.

Bowen, E. (1954). *Return to laughter.* NY: Doubleday.

Chall, J.S. (1983). *Stages of learning to read.* NY: McGraw-Hill.

Chall, J.S. (1983). *Stages of reading development.* NY: McGraw-Hill.

Cole, M. (1988). Cross-cultural research in the socio-historical tradition. *Human Development, 31,* 137–157.

Cole, M. (1990). Cultural psychology: A once and future discipline? In J.J. Berman (Ed.), *Nebraska Symposium on Motivation, 1989: Cross-cultural perspectives* (Vol. 37). Lincoln: University of Nebraska Press.

Cole, M. (1994). A conception of culture for the discipline of Communication. In D. Vocate (Ed.), *Interpersonal communication.* Hillsdale, NJ: Erlbaum.

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

Cole, M., Hood, L., & McDermott, R.P. (1978). Concepts of ecological validity: Their differing implications for comparative cognitive research. *Qtly Newsletter of the Laboratory of Comparative Human Cognition, 2(2),* 34–37.

Crowder, R.G., & Wagner, R.K. (1992). *The psychology of reading.* (2nd ed.). NY: OUP.

D'Andrade, R. (1984). Cultural meaning systems. In R.A. Shweder & R.A. LeVine (Eds.), *Culture theory: Essays on mind, self and emotion.* NY: CUP.

D'Andrade, R. (1990). Culture and cognition. In J.W. Stigler, R.A. Shweder, & G. Herdt (Eds.), *Cultural psychology: Essays on comparative human development.* Cambridge: CUP.

Das, J.P. (1988). Coding, attention, and planning: A cap for every head. In J.W. Berry, S.H. Irvine, & E.B. Hunt (Eds.), *Indigenous cognition: Functioning in cultural context.* Dordrecht: Martinus Nijhoff.

Engeström, Y. (1987). *Learning by expanding.* Helsinki: Orienta-Konsultit Oy.

Estes, W.K. (1976). Intelligence and cognitive psychology. In L.B. Resnick (Ed.), *The nature of intelligence.* Hillsdale, NJ: Erlbaum

Fodor, J. (1983). *The modularity of mind.* Cambridge, MA: MIT Press.

Geertz, C. (1973). *The interpretation of culture.* New York: Basic Books.

Goodall, J. (1986). *The chimpanzees of Gombe: Patterns of behavior.* Cambridge, MA: Harvard University Press.

Goodman, K.S., & Goodman, Y.M. (1979). Learning to read is natural. In L.B. Resnick & P.A. Weaver (Eds.), *The acquisition of reading skills: cultural constraints and cognitive universals* (Vol. 1). Hillsdale, NJ: Erlbaum.

Gottlieb, G. (1992). *Individual development and evolution.* NY: OUP.

Ilyenkov, E.V. (1977). The concept of the ideal. In *Philosophy in the USSR: Problems of dialectical materialism.* Moscow: Progress.

Jahoda, G. (1982). Psychology and anthropology: A psychological perspective. NY: Academic Press.

King, C. (1988). *The social facilitation of reading comprehension.* Unpublished PhD dissertation, University of California, San Diego.

Kroeber, A.L., & Kluckhohn, C. (1952). Culture: A critical review of concepts and definitions. *Papers of the Peabody Museum of American Archeology and Ethnology, 47*(1). Cambridge, MA: Harvard University Press.

Laboratory of Comparative Human Cognition (1982). A model system for the study of learning difficulties. *Qtly Newsletter of the Laboratory of Comparative Human Cognition, 4*(3), 39–66 (Special Issue).

Laboratory of Comparative Human Cognition (1983). Culture and cognitive development. In W. Kessen (Ed.), P.H. Mussen (Series Ed.), *Handbook of child psychology; Vol. 1. History, Theory, and Methods* (4th ed.). NY: Wiley.

Lave, J. (1988). *Cognition in practice.* Cambridge: CUP.

Lewontin, R. (1982). *Human diversity.* New York: Scientific American Books.

Luria, A.R. (1976) *Cognitive development: Its cultural and social foundations.* Cambridge, MA: Harvard University Press.

Luria A.R. (1981). *Language and cognition.* Washington: V.H. Winston.

Macfarlane, A. (1977). *The psychology of childbirth.* Cambridge, MA: Harv. UP.

McClelland, J.L., & Rumelhart, D.E. (1981). An interactive interaction model of contexts effects in letter perception, Part 1: An account of basic findings. *Psychological Review,* 88, 375–407.

Miller, G.A. (1988). The challenge of universal literacy. *Science, 241,* 1293–8.

Newman, D., Griffin, P., & Cole, M. (1989). *The construction zone.* Cambridge: CUP.

Nicolopolou, A., & Cole, M. (1993). Generation and transmission of shared knowledge in the culture of collaborative learning: The fifth dimension, its play-world, and its institutional contexts. In E.A. Forman, N. Minick, & C.A. Stone (Eds.), *Contexts for learning: Sociocultural dynamics in children's development.* NY: OUP.

Orasanu, J., & Scribner, S. (1982). The development of verbal reasoning: Pragmatic, schematic, and operational aspects. In W. Frawley (Ed.), *Linguistics and literacy.* NY: Plenum.

Palinscar, A.S., & Brown, A.L. (1984). Reciprocal teaching of comprehension-fostering and monitoring activities. *Cognition and Instruction, 1,* 117–175.

Rogoff, B. (1989). *Apprenticeship in thinking.* NY: OUP.

Rogoff, B., Baker-Sennett, J., Lacasa, P., & Goldsmith, D. (1994) Development through participation in sociocultural activity. In J. Goodnow, P. Miller, & F. Kessel (Eds.), *Cultural practices as contexts for development.* San Francisco: Jossey-Bass.

Rommetveit, R. (1974). *On message structure.* NY: Wiley.

Rubin, J.Z., Provezano, F.J., & Luria, Z. (1974). The eye of the beholder:

Parents' view on sex of newborns. *Amer. Jnl. of Orthopsychiatry, 44*, 512–519.
Sahlins, M. (1976). *Culture and practical reason*. Chicago, IL: UCP.
Scardamalia, M., & Bereiter, C. (1985). Fostering the development of self-regulation in children's knowledge processing. In S.F. Shipman, J.W. Segal, & R. Glaser (Eds.), *Thinking and learning skills: Research and open questions*. Hillsdale, NJ: Erlbaum.
Segall, M.H., Dasen, P.R., Berry, J.W., & Poortinga, Y.H. (1990). *Human behavior in global perspective*. New York: Pergamon.
Sharp, D., Cole, M., & Lave, C. Education and cognitive development: The evidence from experimental research. *Monographs of the Society for Research in Child Development, 44 Whole no 1–2 (serial Number 178)*.
Shweder, R.A. & Levine, R.A. (1984). *Culture theory: Essays in mind*. NY: CUP.
Simon, H. (1969). *The sciences of the artificial*. Cambridge: MIT Press.
Stone, C.A., & Wertsch, J.V. (1984) A social interactional analysis of learning disabilities. *Journal of Learning Disabilities, 17*, 194–199.
Super, C. (1987) The role of culture in developmental disorder. In C. Super (Ed.), *The role of culture in developmental disorder*. New York: Academic Press.
Tulviste, P. (1991). *The cultural-historical development of verbal thinking*. Commack: Nova Science.
Tylor, E.B. (1871). *Primitive culture: Researches into the development of mythology, philosophy, religion, art, and customs* (2 vols.). London: John Murray.
Valsiner, J. (1989). From group comparisons to knowledge: Lessons from cross-cultural psychology. In J.P. Forgas & J.M. Innes (Eds.), *Recent advances in social psychology: An international perspective*. Amsterdam: North Holland.
Vygotsky, L.S. (1929). The problem of the cultural development of the child, II. *Journal of Genetic Psychology, 36*, 414–434.
Vygotsky, L.S. (1978). *Mind in society*. Cambridge, MA: Harvard Univ. Press.
Wartofsky, M. (1979). *Models*. Dordrecht: D. Reidel.
Wertsch, J.V. (1985). *Vygotsky and the social formation of mind*. Cambridge, MA: Harvard University Press.
White, L. (1942). On the use of tools by primates. *Jul. Comp. Psych., 34*, 369–374.
White, L. (1959). The concept of culture. *American Anthropologist, 61*, 227–251.
Williams, R. (1973). *Keywords*. NY: OUP.

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