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15

Cultural Amplifiers Reconsidered

Michael Cole and Peg Griffin

It arrived in a large package and lay on my desk for some weeks before I found the time to look at it. A Ph.D. dissertation in two, thick, mimeographed volumes: *Cultural Amplifiers and Psychological Differentiation Among Khawabodosh in Pakistan*. The author was Joseph Berland, an anthropologist interested in how culture influences thought. Berland had employed several contemporary psychological concepts and data gathering techniques in his study so he was naturally anxious to see how his ideas fared among psychologists. I qualified as a reader because I am the coauthor of an article concerning inferences about cultural differences in psychological processes. My coauthor was Jerry Bruner.

In that article, which had served as one point of departure for Berland Bruner and I were attempting to come to terms with the problem of how people raised in different cultures (especially subcultures within the United States) are socialized to behave differently in response to a variety of specific intellectual tasks and to schooling in general. In our discussion, we used the notion of a cultural amplifier, which Berland had adopted as an organizing concept in his work. The matter was put as follows: "By an amplifying tool is meant a technological feature, be it soft or hard, that permits control by the individual of resources, prestige, and deference within the culture. An example of a middle-class cultural amplifier that operates to increase the thought processes of those who employ it is the discipline loosely referred to as 'mathematics.' To employ mathematical techniques requires the cultivation of certain skills of reasoning, even certain styles of deploying one's thought processes. If one were able to cultivate the strate-

The preparation of this manuscript was supported by a grant from the Carnegie Corporation to Michael Cole. The reader will note that the first person personal pronoun employed in the beginning of the paper is inconsistent with the fact that this is a co-authored effort. An early draft of this paper served as the focus of extended discussions among the authors that so heavily influenced the outcome of the paper that a joint effort resulted. This collaboration is appropriately marked as the paper progresses, reflecting the structuring of the activities that produced it.

gies and styles relevant to the employment of mathematics, then that rage of technology is open to one's use. If one does not cultivate mathematical skills, the result is 'functional incompetence,' an inability to use this kind of technology" (Cole and Bruner, 1971, p. 872).

I was very impressed with Berland's study. It was an ethnography that provided copious detail on the way traveling Pakistani entertainers and artisans organize the activities of their children. In addition, Berland tested children's and adult's responses to several phychological tasks originally designed to access cognitive and perceptual abilities. He found support for his hypothesis that nomadic groups would develop greater "field independence" (as the term is used by Witkin and his associates) than the sedentary peoples among whom they traveled. He also discovered rather striking precociousness in the speed with which some nomadic children mastered certain Piagetian tasks. Nomadic adults' techniques for organizing their children's activities are seen as the cultural amplifiers (available to nomadic but not to sedentary populations) that provide for their advantages on cognitive and perceptual tasks.

Along with my great interest in Berland's substantive findings, I experienced a sharp sense of discomfort when I thought about the term "cultural amplifiers." My discomfort had two sources. First, the notion had arisen in Professor Bruner's work, not mine. Berland had contacted the wrong predecessor! Second, I had just worked my way through two monographs, both by Soviet psychologists, that had strongly influenced my thinking about culture and cognition. I felt the need to retrace the idea of cultural amplifier which seemed not to quite mesh with the intrumental, cultural-historical approach to the study of mind offered by Lev Vygotsky (1978) and Alexander Luria (1979).

Cultural Amplifiers

The fundamental statement of the concept of cultural amplifier as it is applied in cross-cultural, psychological research is to be found in Jerry Bruner's overview to *Studies in Cognitive Growth*. The intertwining of this notion with development is here obvious. "Man is seen to grow by the process of internalizing the ways of acting, imagining, and symbolizing that 'exist' in his culture, ways that amplify his powers. He then develops these powers in a fashion that reflects the uses to which he puts [them]" (Bruner, 1966, p. 320-21).

Bruner is telling us that the supply of amplifiers in a culture and the demands of life in a culture are two cardinal, cultural determinants of the "powers of mind" that will develop. The two are staged: first there is growth by internalization of amplifiers, then development by the individual's use of those amplifiers. Unfortunately, in 1966 he also had to tell us that "Relatively little is known about . . . the culture's intellectual amplification supplies and the demands that are placed on the individual" (p. 321).

Bruner drew heavily on Weston La Barre's contention that changes in human nature in the past five hundred thousand or so years have resulted largely from a human being's capacity to incorporate external aspects of his environment into his stock of adaptations to the world, a process that La Barre referred to as "evolution-by-prosthesis."

In the evolutionary scheme of things, Bruner supposed that human evolution ("selection and survival") would be shaped by existing implement systems, such that now "We move, perceive, and think in a fashion that depends on techniques rather than on wired in arrangements in our nervous system" (p. 56).

I accepted the spirit of this line of thinking when I read it more than a decade ago, as I do now. But the more I looked at the way in which "amplifier" was used in discussions such as I have quoted from, the more I came to believe that important ambiguities, and hence important misunderstandings, lurked in its byways. In some sense, cultures do provide members with techniques for solving the problems posed by their environments, social as well as physical. But in what sense? Human achievements are thereby increased. But does the increase result from a process of "amplification?"

A Soviet Perspective

Soviet thinking about culture and thought is especially important to include in a discussion of cultural amplifiers for several reasons. As I have already indicated, my own doubts about current usage derive from my experience with the concepts evolved by Vygotsky, Luria, and their colleagues. No less important is the fact that Bruner was similarly influenced. As he recounts in the preface to *Studies in Cognitive Growth*, an exchange of visits with Luria and Alexander Zaporozhets in the late 1950s and early 1960s was important in his thinking. Jerry also wrote an outstandingly prescient preface to Vygotsky's *Thought and Language* when it appeared in 1962 (to which I will return later in this discussion). Had I understood his preface and that book in 1962, many false starts and blind alleys in my own work might have been avoided. But at that time I was just entering my first apprenticeship under Luria's guidance, and I could do little more than assimilate Vygotsky's ideas to my prior experience as a mathematical learning theorist.

However, in the mid-1970s I was engaged, along with several colleagues, in editing heretofore unpublished Vygotsky manuscripts. In the middle of

this enterprise a new task came to hand—to edit, and complete, an autobiography undertaken by Alexander Luria shortly before his death. In coping with these obligations, I was forced to a deeper consideration of two sets of concepts which, in combination, form the center of the Vygotsky-Luria approach to the study of the mind.

In the mid-1920s, influenced by Marx as well as his prior experience as a philologist and educator, Vygotsky concluded that the origins of higher forms of psychological activity are to be found in the individual's social relations with the external world. Man was seen not only as the product of his environment, but also as an active agent in creating his environment. A *psychology* which sought to be a dialectical materialist enterprise needed to discover the ways in which natural processes such as physical maturation and sensory mechanisms become intertwined with culturally determined processes to produce the psychological characteristics of adults. Vygotsky liked to emphasize that we need, in a sense, to step outside the organism in order to discover the sources of specifically human forms of psychological activity.

Vygotsky called his approach variously "cultural," "historical," and "instrumental" psychology. Each term reflected different sources of the general mechanism by which societies mold the forms of activity that separate man from other creatures.

The earliest statement of this overall enterprise was a monograph called "Studies in the History of Behavior" that appeared in 1930 bearing Bacon's epigraph: "The naked hand and intellect by themselves amount to nothing: everything is accomplished with the aid of tools." This idea was at the core of Vygotsky's notion of an "instrumental" psychology that underscored the fundamentally *mediated* nature of all complex psychological functions. Unlike basic reflexes, which can be characterized by a stimulus-response process, higher functions incorporate auxiliary stimuli, which are typically produced by the person himself. The adult responds not only to the stimuli presented by an experimenter or by his natural environment, he also actively modifies those stimuli and uses his modifications as an instrument of his behavior. We know some of these modifications through folk customs such as tying a string around one's finger in order to remember more effectively. Many less prosaic examples of this principle were uncovered in Soviet studies of changes in the structure of children's thinking as they grow from the age of three to ten years (see Cole, 1978; Luria, 1979; Vygotsky, 1978).

The "cultural" aspect of the theory referred to the socially structured ways in which society organizes the kinds of tasks that the growing child faces and the kinds of tools (both mental and physical) that the young child is provided to master those tasks. One of the key tools invented by mankind is language, and Vygotsky placed special emphasis on the role of language in the organization and development of thought processes.

The "historical" aspect merged into the cultural one. The tools which man uses to master his environment and his own behavior did not spring fully developed from the hand of God. They were invented and perfected in the long course of man's social history. Language, one of the inventions, carries within it the generalized concepts that are the storehouse of human knowledge. Opportunity and methods for using and supplementing this storehouse are expanded by specialized cultural instruments like writing (and arithmetic).

Given this instrumental, cultural, and historical nature of psychological functions, a line of reasoning for investigating them is apparent: one could study the various thought operations as they are structured among people whose cultural history had not supplied them with a tool such as writing. Such people should manifest a different organization of higher cognitive processes, but a similar structuring of elementary processes, than people whose cultural history had supplied them with writing.

The close correspondence between these ideas and the idea of cultural amplifiers should be clear. The point is underlined when we look back at Bruner's introduction to Vygotsky's *Thought and Language*, where he points out that "*Thought and Language* elaborates to what sense he believed that in mastering nature we master ourselves. For it is the internalization of overt action that makes thought, and particularly the internalization of external dialogue that brings the powerful tool of language to bear on the stream of thought. Man, if you will, is shaped by the tools and instruments that he comes to use, and neither the mind nor the hand alone can amount to much" (Bruner, 1962, p. vi–vii).

But ideas of tool use and the internalization of tool-linked activity are not sufficient to capture the essence of the cultural-historical school. In addition, we need to examine Vygotsky and Luria's ideas about the nature of psychological functioning, particularly the notion of "function" itself, which, in their hands, took on a special meaning. Luria, in particular, was concerned to promote a richer understanding of the term "function" than is usually encountered in psychology. He pointed out that the term function usually refers to the function of a particular tissue. Perception of light is the function of photosensitive cells in the retina, secretion of insulin is the function of the pancreas. By analogy, hearing was said to be the function of the auditory cortex, planning the function of the frontal cortex, and so on. Such analogies, Luria repeatedly asserted, are misleading. Borrowing from his friend and colleague Peter Anokhin, Luria liked to point out that when we speak of the "function of respiration" we cannot be referring to the function of particular tissue (for example, the alveoli that transport oxygen into the blood.) The whole process of respiration is carried out by an entire *functional system* consisting of many components including the motor, sensory, and autonomic nervous systems. Functional systems are distinguished not only by the complexity of their structure, but also by the flexibility of the

roles played by constituents. In the example of respiration, the activity (maintenance or restoration of homeostasis) and the result (transport of oxygen into the blood) must remain invariant if the organism is to avoid perishing. This complex function, however, can be carried out in a variety of ways should the normal system be disrupted though injury to one of its components. So, for example, if the diaphragm muscles that ordinarily operate to expand the lungs cease to work, intercostal muscles will start to work. It is the presence of an invariant goal performed by variable mechanisms that bring the process to a constant, invariant termination that is the basic feature of a functional system.

Vygotsky applied this view to child development: "I have attempted to demonstrate that the course of child development is characterized by a radical alteration in the very structure of behavior; at each new stage the child changes not only her response but carries out that response in new ways, drawing on new instruments of behavior and replacing one psychological function by another" (Vygotsky, 1978, p. 72–73). Vygotsky's emphasis on the fact that there are variable activities and variable results over the course of development, not merely a more powerful mechanism, means that he views change in the nature of functional systems as the essence of development.

It is when I considered the combined implications of applying the ideas of instrumental-mediated behavior with the notion that all higher psychological functions are in fact functional *systems* that I began to question the wisdom of using the term cultural amplifier when referring to the nature of culture's impact on cognitive development. There are several points where the Soviet perspective does not resonate with the amplifier notion. Depending upon the meaning attributed to the term "amplifier," the idea is either incomplete or misleading.

Cognitive Amplifiers and Cognitive Systems

In its everyday usage (and indeed, in the usages attributed to "amplifier" in the Oxford English Dictionary) the term "amplifier" means roughly to extend, to make more powerful, to complete. It is in this sense that we can speak of the ways in which an automobile amplifies our ability to travel, microscopes amplify our ability to see the world, and mathematics systems amplify our ability to carry out complex calculations. We can say that cultures with writing systems and aerodynamic theory can make their members more powerful, but we are left without a theory to tell us about the mechanisms that produce the added power.

It would be nice if the scientific notion of amplifier, growing out of physicists' investigations of wave-particle phenomena, could suggest a mechanism

for the increased power human beings derive from culture. An amplifier in a scientific sense refers rather specifically to the intensification of a signal (acoustic, electronic), *which does not undergo change in its basic structure.* A weak oscillating signal at 60 hz remains the same shaped 60 hz signal when it is amplified; only the magnitude of the oscillations vary as a function of the amount of amplification. Any ancillary changes signal a defect in the amplification device.

In his discussion of cultural amplifiers in evolutionary perspective, Bruner adopts a position which sounds very much like "amplifier" is borrowed from the physical analogy. "Any implement system to be effective must produce an appropriate internal counterpart, an appropriate skill necessary for organizing sensorimotor acts, for organizing percepts, and for organizing our thoughts in a way that matches them to the requirements of implement systems. These internal skills, represented genetically as capacities, are slowly selected in evolution. In the deepest sense, then, man can be described as a species that has become specialized by the use of technological implements" (1966, p. 56).

This position, which posits an isomorphism between implement systems and "internal counterparts" can reasonably be adopted only by theories of culture and cognition that view cultural differences in cognitive performance as reflecting differential development of one or more basic cognitive capacities (or styles). Thus, for example, within the differentiation framework promoted by Witkin and his associates, individuals are characterized by the "level" of function that they have achieved in terms of their "field independence," the "articulation" of different parts of their cognitive structures, and other dimensions often summarized under the umbrella notion of "cognitive differentiation." (Berry, 1976; Witkin, 1978). The level of global differentiation (or one of its components) is indexed by a test that has more or less correct responses that are summed to give a criterion score (Koh's blocks test, the embedded figures test, the rod and frame test). Because such theories characterize the organism by assigning it values along one or more dimensions which are often developmentally sensitive, it seems natural to characterize the effects of a culturally organized activity such as writing, or mathematics as a quantitative change in "cognitive development." Within the context of such theories, the idea of cultural amplifier seems natural in either its everyday or its technical usage, because structural variation is not represented except in "more" or "less" terms.

But what about theories that posit qualitative changes when children move from one stage of cognitive development to another? If these theories are applied cross-culturally within an "instrumental-cultural" framework such as that proposed by Vygotsky and Luria and accepted in principle by Bruner (under the rubric of "instrumental conceptualization"), what can we make of the notion of amplifier in any other than its common sense meaning? If we accept the position that cognitive growth is characterized by

qualitative changes and that these changes are best described in terms of changes in the relations among the components of complex, functional systems, we arrive at a point where the common sense notion of amplifier could seduce us into unidimensional, quantitative theorizing when we believe that systems thinking is required. From the perspective of a functional systems approach, "amplification" can refer to only one of two aspects of the performance of the system under study. On the one hand, it can refer to the overall performance measured in terms of some outcome criterion. By this product criterion, a sixth grader with a pencil in her hand has a far more powerful memory when confronted with the task of remembering a long list of words than a college sophomore asked to engage in "the same task" without a pencil and paper. On the other hand, "amplification" can refer to the hypothetical process that produces the product criterion. We can claim that the pencil "amplifies" memory power that is "in the head." But this example itself suggests that to use the term "amplification" is to mislead, for one would quickly object that "remembering" in the two cases refers to *qualitatively different activities*. The pencil did not "amplify" a fixed mental capacity. It restructured the activity so that some index of productivity was larger.

It is always a simple enough task for an academic to split words but word splitting ought to help clarify the issue at hand. I have come slowly to the conclusion that the ambiguities of the amplifier metaphor mask a widespread ambivalence (or uncertainty) among scholars about the most fruitful way to conceive of culture's impact on cognition.

When speaking of societies in a comparative way, few psychologists mind the notion that societies differ with respect to the complexity and power of their technologies. Bruner, for example, speaks of the "more evolved technical societies" that are distinguished by division of labor and the arrangement of special contexts for transmitting needed information outside of the contexts of the activity under discussion. A very similar description is to be found in our earlier speculations about the power of education (Scribner and Cole, 1973) and in the work of Greenfield (1972) and Olson (1976; 1977)—which should be no surprise, since we were all influenced by Bruner in our work.

In a common sense way, these kinds of statements are easily interpreted within an "amplifier" framework: technology increases demands on individuals so means are found to provide individuals the amplified abilities they will need. But compare this line of thinking with the interesting conclusion reached near the end of *Studies in Cognitive Growth* that ". . . the unschool Wolof child comes to terms with the idea of equivalence in a fashion that is his own, not something that is "more" or less of some unidimensional, universal pattern" (Bruner et al., 1966, p. 323). Here we have a very relativistic statement about culture and cognitive development consistent with a systems analysis. Yet on the very next page, we return to statements that lead

us to believe that we can rank cognitive behaviors on some sort of scale; technological societies are said to provide a greater push toward building hierarchical connections because in less technological societies there is less reason to connect events beyond the immediate context of use. Elsewhere, we are told that some cultures push cognitive growth better and earlier than others (Greenfield and Bruner, 1966).

The ambivalence reflected in these contrasting statements about cultural comparisons in terms of the technological level of the society (as measured, for example, in Carniero's 1955 work on Guttman scaling of social complexity) is by no means restricted to one example of Bruner's work. For example, in a recent discussion of the impact of literacy on thinking, Bruner and Olson (1977–78) tell us on the one hand that literacy changes the purposes and information demands of manipulating objects in the world. On the other hand, they suggest that interaction with text may be a prerequisite in the "development of intellectual competence"; a quotation from Inhelder and Piaget about the nature of formal operations is provided as an illustration of both literate thought and developed cognition.

It is also important to note that this ambivalence is not unique to Bruner's instrumental conceptualism. It is present, too, in the work of Luria and Vygotsky, exactly the people who pushed hardest for a systems approach to understanding the growth of mind.

In the conclusion to his monograph describing the results of his cross-cultural research in Central Asia in the early 1930s, Luria clearly exhibits the duality of approach that I have attributed to Bruner. For example, he begins his summary by emphasizing the change in the structure of thought wrought by cultural change: "We have considered certain data that show the changes in the structure of mental processes associated with cognitive activity at different stages of historical development, and the major shifts that have occurred in these processes under the impact of social and cultural revolutions" (Luria, 1976, p. 161). But what is the nature of these structural changes? A list of them certainly makes one think that statements are being made about *relative intellectual power*. According to Luria, the new conditions brought about by the advent of Soviet power introduced changes in the motives (and thus the structure of activity) organizing behavior that he characterized as "complex":

> These complex motives, which go beyond concrete practical activity assume the form of conscious planning of one's own labor; we begin to see interests that go beyond immediate impressions and the reproduction of concrete forms of practical activity. These motives include future planning, the interests of the collective, and, finally, a number of important cultural topics that are closely associated with achievement of literacy and assimilation of theoretical knowledge. . . . Perception begins to go beyond graphic object-oriented experience and incorporates much more complex processes which combine what is perceived into a system of abstract, linguistic categories. . . . New, theoretical thought operations

se. . . . Thinking processes begin to involve more and more abstraction and neralization. . . . Gradually we see the "transition from the sensory to the ional" (Luria, 1976, pp. 162–63).

, while working within a framework which conceives of culturally linked gnitive change as a matter of *structural reorganization*, Luria still seems conceive of the outcome of this process in something like mental amplifition terms. Not coincidentally, it was this latter aspect of this work which used a great deal of trouble in the USSR at the time it was done. One mmentator on a theoretical monograph coauthored by Luria and Vygotsky harged that "These authors consider a primitive still not a human being. . . . annibals, Indians, etc., are not primitives from our point of view, but eople whose culture is not a reflection of their biological capacities (as uria and Vygotsky assert) but the result of specific means of production" Frankel, 1930). Matters were little better following the initial reports of perimental work from the expedition, when Luria and Vygotsky were tcoriated with the new charge that "[the cultural-historical theory] is a seudoscientific, reactionary, anti-marxist and anti-working class theory hat in practice leads to the anti-Soviet conclusion that the political policy f the Soviet Union is carried out by people and classes who think primi-ively, unable as they are to engage in abstract thought . . ." (Razmyslov, 934, p. 83–84).

One need not agree with these intemperate criticisms to recognize their ource. Despite attempts to argue that they were showing the positive effects f exposure to a socialist social and economic milieu and in spite of a theory vhich emphasized qualitative differences in thought associated with differ-nt cultures, Luria and Vygotsky were caught by the fact that the qualita-ive changes in the structure of mind that they sought to demonstrate led hem into comparisons among the people involved that were distressingly uantitative in their implications. These implications were given added lausibility by the fact that the terms in which they attempted to describe he cognitive changes wrought by the advent of technological society were lmost precisely the same terms that they used to describe the changes in nental function that differentiate older and younger children (c.f. Luria, 1978; Vygotsky, 1978). Moreover, they were working in a psychological tradition that had for at least fifty years, been willing to contemplate struc-tural if not procedural, similarities between the thinking processes of young children and adults in nonliterate societies (Piaget, 1926; Werner, 1948).

I believe that the same difficulties vitiate a great deal of recent cross-cultural research. Insofar as psychologists have a theory to characterize social and economic differences among cultures, it leads them to rank cultures with respect to their degree of development (or technological sophistication, modernization, and so on). Given a "developmental" characterization of the environment, some "developmental" formulation of cultural differences in thinking seems inevitable. Thus, even when we strive to formulate a

theory of culture and cognition in "systems" terms, the outcome may be virtually indistinguishable from an "amplifier" characterization that comes very close in its implications to the kind of cognitive development theories applied to children in our own society.

Examples of Two Attempts at a "Systems" Interpretation of Culture and Cognition

To sharpen the issues further, it will be helpful to examine the work of two men who have worried about the possibility that cognitive differences among members of different societies may result from reorganization of the process of thinking owing exactly to those technological features of cultures that distinguish them at the societal level.

The first is David Olson, whose recent writings often display an uncanny resemblance to those of Vygotsky and Luria. In a discussion of "culture, technology and intellect" Olson proposes a cultural model of intelligence in which ". . . it is assumed that the culture has already "worked-up" procedures for dealing with the natural environment, these procedures being embodied in the artifacts, institutions, conventions, and technologies of that culture" (1976, p. 190).

The issue of the relation between cultural technology and thought is explored by analogy with judgments of strength. What a man can lift is not determined so much by the size of his muscles as by the technology of his culture (mules, fork lifts, pulleys) *in interaction* with his muscles. The result is that "the underlying processes that go into an act of strength differ depending upon the machine that the man is hooked to" (p. 192). Olson argues, and I agree, that the analogy applies to intellectual performances such as remembering and problem solving, although the changes in mental processes are more difficult to analyze and the analogy produces some difficulties.

Drawing on the classicist Erick Havelock, Olson argues that the introduction of a written language, especially in the form of extended arguments that he characterizes as the essayist technique, biases the way in which literate people think; it facilitates the use of definitions, logical principles, and causal reasoning. Furthermore, use of literate technology places special, new demands on one's cognitive processes specifiable to the level of central nervous system functioning. For example, instead of relying on an acoustic memory in order to perform an epic such as the *Iliad*, one began to rely on "logically connected prose statements, which because they were preserved as a visible artifact, could be reflected on analytically" (p. 195).

Olson cites Ong (1971) and Havelock (1973, 1978) who suggest that intellectual life involves new systems of activity as a result of the evolving

mpact of literate technology: print is said to take over the role previously erved by human memory as a means of preserving and transmitting cultural information; logical analysis is made possible by the reduction on nemory load; logic replaces rhetoric as a means of argumentation; meaning, even theological meaning, came to reside in the text rather than the dogma of the Church. Such changes, if they indeed occur as these authors suggest, would provide a neat parallel to Vygotsky's assertion that development represents: "a change not so much in the structure of a single function (which, for example, we may call memory) as in the character of those functions with the aid of which remembering takes place; what changes is the *interfunctional* relations that connect memory with other functions" (Vygotsky, 1978, p. 49).

A great deal of practice in the literate mode of activity changes the very nature of our knowledge of the world according to Olson. He takes as his example our knowledge of cows:

> One feature of cows, that they give milk, may be called concrete; another feature, that they are mammals, may be called abstract. The question is this: What is the occasion for the "detection" of these different features? *As long as one's purpose* is simply *to competently perform practical actions*, the 'give milk' feature is critical, the 'mammal' feature is a luxury. However, *as soon as one's purpose is to formulate statements from which true implications can be drawn*, one is forced to detect or create features which bear a class inclusion relation to the event in question. The application of this technique of formulating more abstract categories from which true implications can be drawn, when applied to objects, would yield the superordinate taxonomic schemes that Aristotle took to be an 'unbiased' picture of reality. I would prefer to say that taxonomic structures are the picture of reality that results from the repeated application of a particular technology—it is not a natural or unbiased or objective view of reality (Olson, 1976, p. 198).

I will return to discuss other implications that Olson draws from this work, but first I want to examine briefly the contribution of Jack Goody, an anthropologist whose work has been influential in forcing our attention to the significance of literacy as a causal agent in producing both social change and those contrasting characteristics of human intellectual performance that get labeled by such terms as "primitive and civilized modes of thought." Goody enters this discussion in a personal way because in 1974 he worked with me in Liberia and later we both spent time working with Olson, so that the lines of the discussion are by no means independent entities.

Goody's basic contention is that contrasts in mode of thought can be related to changes in the means of communication, particularly the advent of literacy. Writing provides people with new potential for thinking: ". . . [I] would go further and see the acquisition of these means of communication as effectively transforming the nature of cognitive processes. . . " (p. 18).

These transformations take several forms. Like Olson, Goody points to ways in which writing objectifies speech, shifts its information channel to vision and its "executive" channel to the hand. By giving relatively permanent form to a segment of speech, writing facilitates critical analysis, reflective thinking, and exploration of new conceptual relations.

Goody's discussion carefully traces the way in which the development of new powers in the writing system cause new kinds of intellectual activity that in turn produce further changes in literate activities in a dialectical spiral that inexorably, if not evenly, produces increasingly powerful technologies of the intellect. Each step in the process represents a *qualitative* change, but the historical effect can also be described quantitatively by criteria external to the way individuals process information.

In his examinations of very early writing practices, Goody shows how elementary tables and lists were used both as a means of transmitting stored information and as tools for changing the organization of the lists (and therefore the cultural items to which they refer). At one point he summarizes the process as follows: "We can see here the dialectical effect of writing upon classification. On the one hand it sharpens the outlines of the categories; one has to make a decision as to whether rain or dew is of the heavens or of the earth; furthermore it encourages hierarchization of the classificatory system. At the same time, it leads to questions about the nature of the classes through the very fact of placing them together. . . . The fact that no single principle of contrast is adequate to classify all cultural knowledge forces to attention the existence of contradictions, the resolution of which leads to more complex systems" (Goody, 1977, p. 102).

Goody thus suggests the basis for a link between cultural complexity and cognitive complexity, while providing a rationale for comparing cultures (and thus systems of thinking) in terms of their relative power. By linking changes in mode of thought to the nature of communication technologies, Goody proposes that

> we can avoid not only the Grand Dichotomy but also the diffuse relativism that refuses to recognize long-term differences and regards each 'culture' as a thing on its own, a law unto itself. So, on one level, it is. But that is not all there is to say about any set of relations, however clearly defined the boundaries may be. The set exists in the context of a specific constellation of productive relations and of a particular level of technological achievement. The technology, which creates possibilities for, and places limits upon, a wide range of social interaction, changes in the same general direction throughout human history. By 'general,' I mean to allow for some backward movement (the decay of the 'useful' arts that WHR Rivers observed in certain areas of Melanesia), as well as for the development of a plurality of differing traditions. Nevertheless, there is direction, especially in the areas of what has been called 'control over nature' and the 'growth of knowledge,' and this movement is related to developments in the technology of the intellect, to changes in the means of communication and, specifically, to the introduction of writing (p. 151).

Here, if we will accept it, is a "psychosocial" theory of how cultural and ıental development are related and a way to resolve the ambiguities of preıous discussions. Combining Vygotsky, Olson, and Goody, we can say that ıinking is always and everywhere the internalization of the means, modes, nd contents of the communications activities that exist in the culture into ·hich one is born. These activities and the instruments invented to facilitate ıem have evolved to cope with the demands placed upon cultures for their urvival and propagation; moreover, they also carry within them the seeds ıf their own undoing, seeds that will bear fruit when the proper social conlitions exist, making possible further change as a consequence of interacions between new generations of technologies and peoples. In terms of our ıeginning metaphor, technologies transform the nature of culture and hought, increasing (amplifying) the *products* of human labor.

It is a very neat solution and, in general outline, it is probably correct. 3ut it is incomplete as regards the mechanism by which individuals come to ıcquire different kinds of communication-dependent functional cognitive ;ystems. It may also overestimate greatly the generality of the cognitive consequences of interacting with cultural technologies.

I do not propose to discuss the problem of the mechanisms by which individuals come to master complex, instrumentally mediated thought systems in the course of individual development. It may plausibly be argued that the structure of written language, the school-based uses of language, the nature of oral interaction between parents and children, the properties of an alphabetic orthography, exercise in the essayist technique, or manipulation of symbol systems that allow a reduced memory load all contribute. Careful empirical studies of this process in our own society (for example, Luria, 1978; Olson and Nickerson, 1978) as well as societies where literacy and schooling do not co-vary (Scribner and Cole, 1980) will be needed to determine *how* these tangled factors are involved in special kinds of mediated learning.

However, I do want to propose the possibility that the cognitive changes plausibly argued for in all of this work play a more restricted role in the cognitive activity of individuals than the historical record, anthropological evidence, and scanty experimental data lead us to believe.

Literacy As a Tool for Thinking: General or Specific?

I have found it useful, like Olson, to contrast our notions about intellectual power wrought by a variety of tools with the physical work that tools facilitate. To elaborate on a line of argument proposed by Olson, suppose that we were discussing cultural amplifiers for killing. Suppose further that the tools we wanted to analyze were bows and arrows on the one hand and

rifles on the other. It seems pretty clear that bows and arrows are less effective cultural "kill" amplifiers than rifles and that a criterion measure like "number of deer shot in the month of November" for two groups thought equivalent in deer-finding skills would show that guns were superior to bows and arrows. Certainly Columbus's hosts in the New World and their descendants came to believe in the greater power of rifles. When, however, we consider this contrast from the perspective of the different systems of activities that are involved in their use, we must be loath to say that the use of bows and arrows or rifles led to any general difference in the "killing ability" of the individuals using these tools *when the tools were not in their hands*. The changes in "killing ability" reside jointly in the tool and the user. We might, to be sure, want to claim that there were changes in skills deemed relevant to killing ability that might be differentially promoted by the two kinds of tool use, that is, the bow and arrow hunter might have learned to get closer to her prey without being detected. This possibility is relevant to the overall argument and will be considered below.

When we look at discussions of cultural amplifiers, or more generally, at discussions of culture and cognitive growth that attempt to clarify the role of "tools of the intellect" we find [redacted] a strong predilection to assume that individuals' interactions with such tools changes them in a way that is analogous to claiming that they have different killing ability *even when they have no weapons in their hands*. At least, this is how I interpret the kinds of generalizations made by Luria based on his Central Asian data and Bruner and his colleagues when they talk about the possibility that some cultures promote cognitive growth more effectively than others. Similar claims seem to be made by Olson (1977), Goody (1977), and Scribner and Cole (1973).

How can we assess the generality of the intellectual consequences of interacting with a particular kind of cultural technology of the intellect? If we were to make a test of "killing power," we would probably put the tools at issue in the hands of people recognized to be skilled practitioners and then observe the outcome of some tests.

We don't typically do that with "tools of the intellect." Instead, as in the case of schooling (Bruner et al., 1966; Cole, Gay, Glick, and Sharp, 1971; Sharp, Cole, and Lave, 1979) we present people some "representative cognitive task" under conditions where the theoretically crucial tool is *not* available for use. In effect, we assess the residual, "general power" that is available as a consequence of interaction with the tool. It is probably not too fanciful an analogy to say that we test for the "killing" power" of bow and arrow shooters versus rifle shooters when both classes of people are barehanded.

There are a number of rationales to support the notion that interaction with intellectual tools leaves residual mental power that can be used in their absence. Although specific theories take somewhat different forms,

they are all variants on the notion that an activity initially engaged in as part of an interaction with the external environment (physical or social) can be internalized. That is, the individual can mentally reconstruct essential features of the original environment using remembered representations of what went on there to guide present action. Bruner and his colleagues have emphasized language and particularly the special role that language acquires in school settings as a key mediator in the process of rendering the consequences of interaction with cultural tools general. Language is common both to the settings where "literate" and "oral" thought are engaged in, so it is a natural candidate to the mechanism of transfer. For example, Bruner and Olson (1977–78) identify writing as a tool that facilitates going back over one's experience to "re-present" it to oneself. It is a generally useful activity that is emphasized in one particular setting, highly elaborated in technological societies, the school, but applicable everywhere: "This form of metaprocessing, of re-presenting knowledge in various symbolic forms, comes into play in many circumstances—in failed communication, in our inability to interpret what we encounter, when we run into interpersonal conflict, when we run into difficulties in attempting to carry out an action or solve a problem"(p. 6).

It is in this spirit that Olson identifies writing as an example of ". . . highly generalizable and highly usable, life valuable (cognitive) operations that are responsible for intelligent behavior" (1976, p. 189).

All of these arguments are plausible, but there is more than a little evidence to suggest that while cognitive changes arising from literacy or schooling are not completely specific to literate or school tasks, they certainly do not represent general changes in the way people process information.

Consider, for example, the evidence summarized by Shweder to support his contention that the modes of thought that characterize traditional, nonliterate peoples are no different from those that are employed by American college students. Shweder focuses on a class of problem-solving settings where individuals have to make judgments about the similarity and co-occurrence of events. He begins with a question: ". . . how is the student of the Azande to comprehend their attempts to cure epilepsy by eating the burnt skull of a red bush monkey or their therapeutic application of fowl's excrement in cases of ringworm?" (Shweder, 1977, p. 637). Shweder's basic contention is that such inferences are made because people have difficulty keeping track of the relevant information. One example he uses to demonstrate the problem that he thinks underlies all mundane reasoning comes from the work of Ward and Jenkins (1965).

Ward and Jenkins concocted a problem in which subjects had to determine if cloud seeding causes rainful. Subjects were presented the information in two ways. Some subjects were presented information on a trial by trial basis (for example, it rained, the clouds were seeded; it did not rain, the clouds were not seeded; and so on). Over a long series of trials, the information about occurrences and nonoccurrences of the two events, seeding and rain, could lead to a correct inference about the causal significance of cloud seeding. But when the information was presented in this way, less than one in five subjects made the correct inference. However, if the information was presented in a 2 X 2 table so that the data were simultaneously available, correct inferences almost always occurred. From this kind of demonstration, Shweder concludes that "Most normal adults have the capacity to think correlationally, but they do not apply the concept in their everyday life judgments" (p. 639). Shweder goes on to show how the confusion of likelihood and correlation contribute to magical thinking in all societies. But what is of central concern to us is the question of why correlational thinking is not characteristic of the everyday life thinking of the educated adults he studied.

The answer to this question hinges upon the kind of information that is available to the individual at the point where he has to make a judgment. A good deal of evidence suggests that in the situations that Shweder refers to as "everyday," information has been lost about the relevant event co-occurrences because there is a great deal of information presented sequentially over quite a time span. Moreover, the loss is not random. Nonoccurrences of events are differentially forgotten (see Estes, 1976). The circumstance that overcomes these difficulties is one that relies on a literate technology for its efficacy; the convention of a contingency table summarizes the relevant information and reduces the memory load on the individual to almost zero, with the result that a proper inference is possible. In short, writing produces a change in the "interfunctional relations among cognitive processes," a change that produces veridical problem solving. Central to the present argument, these results suggest that it is unnecessary to posit a general change in internal cognitive activity as a consequence of literacy—*the effect requires that the tool be in the user's hand.*

Other data suggest that even paper and pencil are not sufficient to insure veridical judgments of similarity unless they are used in the right way at the right time. The seminal work here was carried out by D'Andrade (1974) in his analysis of behavioral descriptions of people interacting in small groups. D'Andrade found that when standard rating schemes were used to describe participants' interactions (friendly, helpful, aggressive, and so on) raters were strongly influenced by the meanings of the words used *independent of the participants' behaviors.* Veridical descriptions occurred only when the paper and pencil rating scheme was applied while the rater was observing the coding behavior. A brief delay between observation and judging (a delay long enough to allow memory-sans-pencil to operate) produced descriptions that were better predicted by knowing the associative network into which the rating words fit than by "remembering" what people actually do.

Still another source of data that might make us question the need to posit general consequences of literacy comes from recent work on "constructive" remembering (see Bransford, 1979). The basic phenomenon here is illustrated by the following example from the work of Paris and Carter (1973). They presented seven- and ten-year-old children with sets of three sentence "stories" like the following:

The canary is in the cage.
The cage is on the table.
The canary is yellow.

The children were later asked to recognize these sentences along with sentences that they had not seen before such as "The cage is under the table" or "The canary is on the table." The children automatically integrated the information in the initial set causing them to mis-recognize sentences like "The canary is on the table" which were true inferences from the information initially given to them. This same result is true for college students as well.

In some of our recent work in Liberia we found that literacy has no noticeable impact on this process. Nonliterate adults were as likely as literates to make errors on sentences that were correct inferences from the information initially given and no less likely to reject other statements that were not in the presentation set. On the face of it, these studies suggest that literate practice and schooling (which involves a variety of literate practices) do not produce the kinds of changes in information processing which more traditional cross-cultural research has repeatedly claimed.

Literate adults' proclivity to such constructive remembering is a vexing problem in our law courts, where subtle changes in the way that a lawyer's probe of witnesses' recall of events have been shown to determine what "they remember" (Loftus, 1979). Juries have also been shown to change their decisions of guilt or innocence not on the nature of the evidence presented, but the order in which that evidence is presented (see Anderson, 1978).

We often do little better in the way that we go about solving complex problems that are presented to us daily in the course of getting around our social environments. Indeed, Bartlett (1958) was led to conclude that Cambridge students engage in two completely different kinds of thinking ("experimental" and "everyday") that proceed in very different ways.

Such differences within the experience and practice of literate adults are known to us all, but they are peculiarly missing from discussions of culture and cognitive development. The key point of resolution, I believe, is to be found in the passage quoted from Olson in which he discussed different ways to "know about cows." In the italicized passages, Olson poses two classes of purposes to which knowledge about cows might be put; to perform a practical action and to formulate statements that generate true implications. The same resolution is contained in Luria's phrase "Once we go beyond concrete practical activity" and Bruner and Olson's emphasis on the role of literacy in promoting theoretical activity. All of these statements imply that literacy will be an effective tool for a circumscribed set of human activities. They are extremely important activities, but they are not all of the purposes that engage most of us most of the time, and they are not all of a piece. Our experience as highly literate scholars urges on us the recognition that the tools of intellect acquired in the classroom and library carrel are *not* general purpose devices. This conclusion is brought home to us in a particularly powerful way by the work of Ebbesen and Konecni (1979) who compared a legal expert's decisions about the sentence to be meted out to defendants in one of two ways. First, a critical list of attributes pertaining to the crime, the defendant, and the circumstances of the cases were placed in written form before the judge who numerically weighted the contribution of each piece of evidence to his decision about sentencing. When data were collected in these same individual's courtrooms, their actual decisions were found to be arrived at quite differently. With the same information in hand and the same hypothetical purpose to their thinking, these highly literate individuals' acted as if their behavior were guided by very different purposes. And so it was. In the experiment the subject had to use (as a covert criterion) his imagined notion of what the experimenter would consider a rationale. But in the courtroom, the criterion of rationality was substituted for the social and political rationality of the society that brought the defendant to court in the first place.

I think that this line of work, when combined with the accumulating evidence that previous anthropological reports of native thinking have undervalued the cognitive power of natives' behavior (as in Hutchins', 1979a, 1979b work on legal reasoning and spatial navigation) and wide recognition of the special problems of inference that arise in the application of laboratory-style experiments in cross-cultural settings, urges on us the most extreme caution in attributing cultural differences in the ability to think "theoretically," "rationally," or in a "context free manner." There is reason to believe that such statements have a basis in fact, but the nature of the facts is not so clear as our metaphors may have seduced us into believing.

There are other difficulties with current attempts to relate cultural technologies to cognition, especially when the discussion assumes that there is a strong sense in which we can speak of both cultural and cognitive development.

For one thing, the existence of a particular technology does not mean that the technology will be exploited in the manner that we discover, *post hoc*, as in studies of the applications of writing. The wheel, certainly a cultural technology recognized to have very wide applicability in amplifying humankind's transportation capabilities, did not inevitably come to play the role that we associate with it. Archeological evidence from Mexico (Farb,

1968) indicates that the wheel existed as a *potential* cultural technology for transportation in meso-America, but it remained instead an implement used by children in their games, or perhaps in adult ritual. It did not become part of a system of activities culminating in sophisticated transportation devices because other elements of culture necessary (or at least helpful) in creating the conditions for inventing the wheel-as-we-understand-it (beasts of burden, for example) did not exist. Similarly, proto-writing systems are known to be exceedingly old, perhaps as much as ten thousand years old (Shmandt-Besserat, 1978). The evolution of modern writing systems, however, required an intricate interplay between many different cultural technologies for its realization. A simple relationship between the existence of a form for a technology and a "level" of technological development cannot be assumed.

That a technological element has complicated relations with other elements in the cultural system is an additional problem. Above, we described how the structure of judges' reasoning varies with variations in motivations derived from the elements operating in different settings. We should also expect that the structure of various cultural tools found in different cultural systems would vary, again with motivations derived from differential relations with different elements. The rifle and bow-and-arrow analogy is an example of the problem. A culture with a rifle for deer killing may have different systems for preserving food and tanning leather and/or different population feeding needs than a culture with a bow and arrow. These differences in the systems in which the tools participate may be related to the putative measurement device we suggested; that is, killing as many deer as the tool user can during a specified period of time may be differentially affected not only by the tool but also by the structure of the tool as motivated by the differences in the systems in which it participates.

There is also the serious problem of establishing the general validity of schemes which rank cultures with respect to some developmental or evolutionary scheme. While, as Goody points out, there are seemingly undeniable contrasts to be found with respect to some cultural elements, especially those related to modern technology and its concomitants, in many spheres of experience (for example, the politics of family life) it seems virtually impossible to apply such schemes. Insofar as the rules that regulate activity in these spheres influence cognitive activity, evolutionary schemes will be inappropriate. Unfortunately, cognitive psychologists have little that is specific to offer on this problem.

The notion that writing systems and their sequelia in the modern world represent cultural tools that amplify mind has been found inadequate to represent the transformations in activity that literacy engenders. But these difficulties in no way require us to ignore the fact that the acquisition of literate powers is a landmark step forward in man's evolving capacity to operate effectively on his environment. This essay, littered as it is with the

shards of previous scholarly written discussions, is testimony in form to the complex system of activities that went into its production. We think that writing down our ideas, mulling them over, coming on new sources we had not clearly understood or remembered, writing some more, getting distracted, talking intermittently to one another, and then finally sitting down to put all the pieces together is a very different process than we could possibly have engaged in without the many literate tools involved. Writing and reading did not, however, amplify our paper-writing power. They reorganized the process whereby we retrieved, compared, listed, and ordered our ideas and, eventually, transmitted them to you. Perhaps they amplified the product; that is for you to decide.

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16

Bruner: A Case of "Cultural Transmission"

Jacqueline J. Goodnow

How are we to describe the way societies and individuals affect one another, especially when the area of effect is as elusive as the way we "think", the way we set goals, make choices, and accept, tackle, solve, or abandon problems? A large part of Jerry Bruner's concern has been with the vehicles by which such interaction takes place. Language has been the prime candidate for analysis. The language of the culture provides the categories used or adapted by an individual: "The categories in terms of which man sorts out and responds to the world around him reflect deeply the world into which he is born . . . his personal history comes to reflect the traditions and thought-ways of his culture, for the events that make it up are filtered through the categorical systems he has learned" (Bruner, Goodnow, and Austin, 1956, p. 10).

In addition to language, however, is a much broader set of "symbolic tools" or "symbolic forms" proposed by Bruner as ways by which a culture is transmitted or changed:

> Theories, models, myths, cause and effect accounts, ways of looking and seeing as well as thinking are probably *the* prime prosthetic devices for assisting nervous systems beyond their naked limits . . . theories quickly become the valued property of a culture, constantly undergoing revision and often refinement toward greater abstraction as they find more compact restatement in the arts and in myth as well as in the formalism of science (Bruner, 1971b, p. 126).

Of particular help in preparing this essay has been the thesis of Keith Weeks Lyou (Kay Lyou): "In search of the sources of rationality: A study of the work of Jerome Bruner." The thesis, written for the Master of Arts degree at Lindenwood College (Missouri) and generously lent to me by Ernest Hilgard, covers the complete range of Bruner's work with a nice attention both to detail and to major themes. It also contains excerpts from interviews with Bruner, Hilgard, and Skinner, so that one has a sense both of Bruner's work and of its general context.

The Social Foundations of Language and Thought

Essays in Honor of Jerome S. Bruner

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