

1 A cultural-historical approach to distributed cognition

Michael Cole and Yrjö Engeström

It was supposedly Goethe who observed that everything has been thought of before; the task is to think of it again in ways that are appropriate to one's current circumstances. Whoever made the remark, we have thought of it often in relation to the current wave of discovery that both the content and process of thinking (however those slippery terms are interpreted) are distributed as much among individuals as they are packed within them.

Our own rediscovery of the distributed nature of mind has grown from our acquaintance with the cultural-historical school of psychology. Consequently, we have decided to explore approaches to distributed cognition by tracing this line of thinking back to the origins of psychology as a distinct discipline, by relating how it was developed by the cultural-historical school of psychology earlier in this century, and by suggesting the advantages of working within the cultural-historical framework (informed by modern cognitive psychology, anthropology, and sociology) when studying cognition as a distributed phenomenon.

Wundt's version of distributed cognition

Around the time that psychology was celebrating its centennial as a scientific discipline, there was a good deal of discussion about the work of Wilhelm Wundt – according to the discipline's folklore, the “father” of scientific psychology (Blumenthal, 1980; Farr, 1987; Toulmin, 1981). Among the many issues raised in this reevaluation was the failure of modern psychologists to realize that virtually half of Wundt's writings were devoted not to the study of elementary sensations using brass instruments and the method

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of trained introspection, but to the study of historically accumulated, culturally organized knowledge as revealed in the written accounts of explorers and early anthropologists as well as the analyses provided by philologists and historians (Wundt, 1921).

The better known half of Wundt's dual system was called "physiological psychology," the study of immediate experience based on the experimental method. The goal of this half of the discipline was to determine how elementary sensations arise in consciousness and the universal laws by which the elements of consciousness combine. The label "physiological" for this half of Wundt's enterprise is somewhat misleading, because experiments carried out in its name rarely involved physiological measurement. Rather, it was believed that the verbal reports of subjects who were presented carefully controlled stimuli would yield results that could eventually be traced to physiological processes. Experiments conducted with this goal in mind concentrated on the qualities of sensory experience and the decomposition of simple reactions into their components. The psychological processes corresponding to external stimulation were presumed to take place inside of individual people's heads.

The other half of Wundt's system involved the study of "higher psychological functions," including processes of reasoning and the products of human language. Wundt claimed that this second branch of psychology, which he called *Völkerpsychologie*, could not be studied using laboratory methods focused on the contents of consciousness, because the phenomena being studied extend beyond individual human consciousness. He argued, for example:

A language can never be created by an individual. True, individuals have invented Esperanto and other artificial languages. Unless, however, language had already existed, these inventions would have been impossible. Moreover, none of these has been able to maintain itself, and most of them owe their existence solely to elements borrowed from natural languages. (Wundt, 1921, p. 3)

According to Wundt's view, higher psychological functions had to be studied by the methods of the descriptive sciences, such as ethnography, folklore, and linguistics. The results were to be formulated in terms of historically contingent phenomena that could be described but not explained according to the canons of experimental science. Wundt believed that the two enterprises must supplement each other; only through a synthesis of their respective insights could

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a full psychology be achieved. To those who would claim that *Völkerpsychologie* could be entirely subsumed under experimental psychology, Wundt replied that “individual consciousness is wholly incapable of giving us a history of the development of human thought, for it is conditioned by an earlier history concerning which it cannot of itself give us any knowledge” (Wundt, 1921, p. 3). In modern terms, Wundt was arguing that while elementary psychological functions may be considered to occur “in the head,” higher psychological functions require additional cognitive resources that are to be found in the sociocultural milieu.

The same folklore that tells us that Wundt was the founding father of the discipline also holds that within a few decades Wundt’s influence dwindled to insignificance; his methodology was rejected and his distinction between physiological/experimental and cultural/descriptive approaches was ignored. However, there is no mistaking the fact that those currently interested in distributed cognition have rediscovered some of Wundt’s ideas, especially his ideas about *Völkerpsychologie*, the methods for its study, and the difficulty of reconciling data obtained from the two ways of knowing about minds.

Hugo Münsterberg

In view of the fact that many of the people who study distributed cognition gather their data from socially valued, practical activities, such as those that occur in schools, hospitals, and the workplace, it is interesting that Hugo Münsterberg, the “father of applied psychology,” fully adhered to Wundt’s dual-psychology distinction and provided one of the earliest systematic statements of the distributed nature of cognition. Münsterberg (1914, p. 16) referred to the experimental half of Wundt’s program as “causal” psychology and the descriptive half as “purposive” psychology, warning that it was “extremely important to keep them cleanly separated and to recognize distinctly the principles which control them.”

In connection with his discussion of the purposive half of psychology, Münsterberg (1914) argued that cognition occurs not only “in the head,” where millions of brain cells interact outside the range of consciousness to “remember for us,” “to think for us,” “to will for us,” but in the objective elements of communication among individuals:

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A letter, a newspaper, a book, exists outside of the individuals themselves, and yet it intermediates between two or between millions of persons in the social group. . . . The book remembers for the social group, and the experiences of the group, objectively recorded in it, shape the social action and the social thought. The letter can connect any distant social neurons; the paper may distribute the excitement from one point of a social group to millions of others. Every objectified expression becomes a social short cut. (pp. 267–8)

Although there is a renewed interest in the ideas of these pioneer psychologists (see, e.g., Cahan & White, 1992; Farr, 1987; Toulmin, 1981), the overall programs they espoused did not give rise to any recognizable, modern approach to human cognition.¹ History (thus far) has been kinder to the originators of the cultural-historical approach associated with the names of Alexei Leont'ev, Alexander Luria, and Lev Vygotsky.

The cultural-historical approach

The basic ideas of cultural-historical psychology are contained in a series of articles and monographs written in the late 1920s and early 1930s (Leont'ev, 1932; Luria, 1928, 1932; Vygotsky, 1929, 1960). While remaining firmly committed to a Darwinian theory of human phylogeny, one of the central tenets of the cultural-historical school is that “the process of the historical development of human behavior and the process of biological evolution do not coincide; one is not a continuation of the other. Rather, each of these processes is governed by its own laws” (Vygotsky, 1960, p. 71).

The presumed qualitative discontinuity between human and animal development is characterized in a variety of interlocking ways by the initiators of the cultural-historical school. In the first article about

¹ A possible exception to this generalization is John Dewey. Although Dewey cannot be considered a major influence in contemporary cognitive psychology, his ideas about education and development continue to be influential among social scientists. In a small book summarizing his ideas about education and experience, Dewey (1938/1963) wrote the following: “Experience does not go on simply inside a person. . . . In a word, we live from birth to death in a world of persons and things which is in large measure what it is because of what has been done and transmitted from previous human activities. When this fact is ignored, experience is treated as if it were something which goes on exclusively inside an individual’s body and mind. It ought not to be necessary to say that experience does not occur in a vacuum. There are sources outside an individual which give rise to experience” (p. 39).

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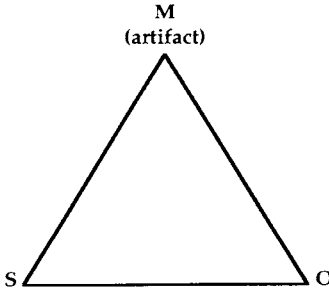


Figure 1.1. The basic mediational triangle with subject (S), object (O), and medium (M) at its vertices indicating the basic constraints on mind.

the school's ideas to appear in English, Alexander Luria opens with the well-known assertion that "man differs from animals in that he can make and use tools." These tools, he writes, "not only radically change his conditions of existence, they even react on him in that they effect a change in him and his psychic condition" (Luria, 1928, p. 493).

The structural change that arises *pari passu* with tool mediation is that "instead of applying directly its natural function to the solution of a particular task, the child puts between that function and the task a certain auxiliary means . . . by the medium of which the child manages to perform the task" (Luria, 1928, p. 495). The basic structure of human cognition that results from tool mediation has traditionally been pictured as a triangle, as in Figure 1.1.

Simplifying for purposes of explication, "natural" ("unmediated") functions are those along the base of the triangle; "cultural" ("mediated") functions are those where interactions between subject and object are mediated by an auxiliary means, at the vertex of the triangle. While Luria's initial statement seems to imply that the cultural route totally replaces the natural route, in many places in his writings and those of his colleagues it is made clear that both routes exist simultaneously. Such a conclusion is necessary because human beings do not cease being phylogenetically evolved creatures by virtue of their ability to create, transmit, and acquire culture.

The way in which Luria writes about tool mediation may incline one to think that he had in mind such tools as hoes and plates. However, he and his colleagues considered language to be an integral part

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of the overall process of cultural mediation, the “tool of tools,” and they had a decidedly two-sided notion of tool mediation. As Vygotsky explains in his monograph “Tool and Symbol” (1978), what we conventionally call tools and what we conventionally call symbols are two aspects of the same phenomenon: Mediation through tools was said to be more outwardly oriented, mediation through signs was more inwardly oriented, toward “the self,” but both aspects adhered in every cultural artifact.

Many years later, Luria (1981) summarized the psychological consequences of culturally mediated behavior, referring in particular to human language, as follows:

The enormous advantage is that their world doubles. In the absence of words, human beings would have to deal only with those things which they could perceive and manipulate directly. With the help of language, they can deal with things that they have not perceived even indirectly and with things which were part of the experience of earlier generations. Thus, the world adds another dimension to the world of humans. . . . Animals have only one world, the world of objects and situations. Humans have a double world. (p. 35)

Here we see clearly that the classical mediational triangle is a description of the basic structural constraints on individual human cognition. But such a static description leaves out the dynamic, double world of which Luria writes. Consequently, we have to add another dimension to this structural picture – time – in the course of which the two worlds (the directly given and the culturally mediated) are constantly synthesized to provide the mental foundations of people’s real-time actions in the world. This expanded version of the basic mediational triangle is shown in Figure 1.2, which emphasizes the fact that cognition requires analysis and synthesis of (at least) two sources of information in real time.

An important implication of these remarks is the assumption that other human beings, both those present to the senses and those of prior generations, play a crucial role in the formation of human cognitive capacities. This point is summed up in what Vygotsky (1934/1987) called the “general law of cultural development”:

The history of the development of signs brings us, however, to a far more general law that directs the development of behavior. Janet calls it the fundamental law in psychology. The essence of the law is that the child in the process of development begins to apply to himself the very same forms of behavior which others applied to him prior

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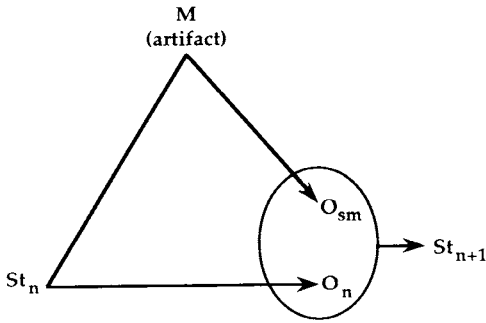


Figure 1.2. The basic mediational triangle with time included in the unit of analysis. This figure symbolizes the fact that new states of the subject arise from coordination of information from both the mediated (cultural) and direct (phylogenetic) connections between subject and object. M, Medium; St_n , subject's state of knowledge at time n ; O_{sm} , object as represented via the medium; O_n , object at time n ; St_{n+1} , emergent new state of subject's knowledge at time $n + 1$.

to that. The child himself acquires social forms of behavior and transposes those on to himself. . . . The sign originally is always a means of social contact, a means of influence upon others, and only subsequently does it find itself in the role of a means for influencing oneself. (Vygotsky, 1960, p. 192)

Although useful as schematic “minimal structures” of human cognitive functions, the mediational triangles in Figures 1.1 and 1.2 fail to account for the collective nature of human activities, or activity systems as Leont’ev (1978, 1981) called them. In Figure 1.3 we have added certain crucial elements to the abstract, individual model depicted in Figures 1.1 and 1.2. First, the fact that individuals (“subject”) are constituted in communities is indicated by the point labeled “community.” As indicated in Figure 1.3, the relations between subject and community are mediated, on the one hand, by the group’s full collection of “mediating artifacts” and, on the other hand, by “rules” (the norms and sanctions that specify and regulate the expected correct procedures and acceptable interactions among the participants). Communities, in turn, imply a “division of labor,” the continuously negotiated distribution of tasks, powers, and responsibilities among the participants of the activity system.

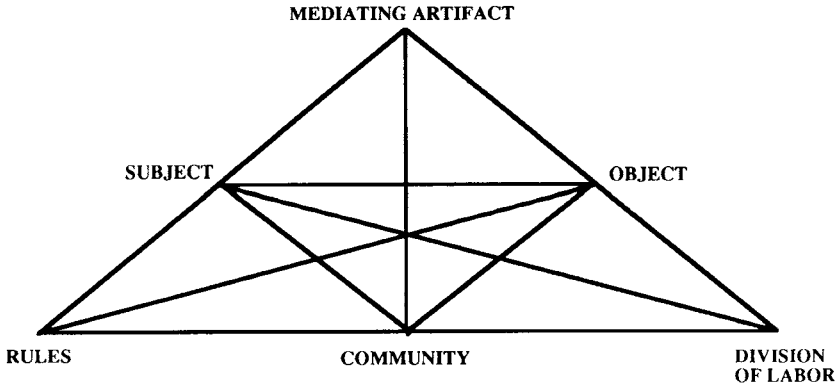
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Figure 1.3. The basic mediational triangle expanded (after Engeström, 1987) to include other people (community), social rules (rules), and the division of labor between the subject and others.

Using Figure 1.3 to represent the idea that activity systems are a basic unit of analysis leads to certain important insights. First, it provides a conceptual map to the major loci among which human cognition is distributed. Second, it includes other people who must somehow be taken into account simultaneously with the subject as constituents of human activity systems.

Another important feature of activity as a basic unit of analysis of human behavior is that when activities become institutionalized, they are rather robust and enduring. Once they gain the status of cultural practices, they often have radically longer half-lives than an individual goal-directed action. In fact, activity systems such as those that take place in schools and doctors' offices, for example, appear to reproduce similar actions and outcomes over and over again in a seemingly monotonous and repetitive manner that gives cultural constraints on action a seemingly overpowering quality. However, closer analysis of apparently unchanging activity systems reveals that transitions and reorganizations are constantly going on within and between activity systems as a fundamental part of the dynamics of human evolution.

Consequently, activity systems are best viewed as complex formations in which equilibrium is an exception and tensions, disturbances, and local innovations are the rule and the engine of change. When an

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activity system is followed through time, qualitative overall transformations may also be found. Institutionalized activity systems seem to move through developmental cycles that typically last years (Engeström, 1987).

We can summarize the cultural-historical conception of the basic structure of human activity as follows:

1. The psychological functions shared with our prehuman cousins, so-called natural functions, develop according to principles that are different from psychological functions that are mediated through tools and rules – for example, “cultural” functions.
2. Cultural mediation creates a species-specific, universal structure of human mind and associated morphology of action.
3. Cultural mediation has a recursive, bidirectional effect; mediated activity simultaneously modifies both the environment and the subject.
4. Cultural artifacts are both material and symbolic; they regulate interaction with one’s environment and oneself. In this respect, they are “tools” broadly conceived, and the master tool is language.
5. The cultural environment into which children are born contains the accumulated knowledge of prior generations. In mediating their behavior through these objects, human beings benefit not only from their own experience, but from that of their forebears.
6. Cultural mediation implies a species-specific mode of developmental change in which the accomplishments of prior generations are cumulated in the present as the specifically human part of the environment; culture is, in this sense, history in the present.
7. Cultural mediation implies a special importance of the social world in human development since only other human beings can create the special conditions needed for that development to occur.
8. A natural unit of analysis for the study of human behavior is activity systems, historically conditioned systems of relations among individuals and their proximal, culturally organized environments.

Although accepting activity systems as a unit of analysis in principle, Russian cultural-historical research based on the ideas summarized here was restricted primarily to the level of individual actions using the “method of dual stimulation.” The basic idea of this method (see Valsiner, 1988, for an excellent, extended discussion) is to put a person in a problem-solving situation where direct action proves ineffective, so that the individual must find or create auxiliary means to

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reach the goal. In the hands of Vygotsky, Luria, and Leont'ev, experiments using this method were also considered a specific version of a microgenetic experiment, which provoked the process of psychological change under controlled laboratory conditions.²

A wide variety of studies carried out by Russian cultural-historical psychologists made use of this method. For example, in studies of the development of voluntary behavior in young children, Alexander Luria demonstrated that the acquisition of self-control in simple situations where children were asked to squeeze a rubber bulb or refrain from squeezing was intimately related to the children's ability to mediate their activity through language. Such results substantiated his belief that "voluntary behavior is the ability to create stimuli and to subordinate [oneself] to them; or in other words, to bring into being stimuli of a special order, directed at the organization of behavior (Luria, 1932, p. 401).

Just as studies with children could lay bare the way in which the acquisition of mediational means was crucial to the ontogeny of behavior, so such studies of the mediational means crucial to the remediation of behavior in cases of injury or disease could permit analysis of the microgenetic processes of everyday thinking. In a well-known early example of this principle, Luria and Vygotsky carried out pilot work with a patient suffering from Parkinsonism. So severe was this condition that the patient could not walk across the floor. Paradoxically, however, the patient could climb stairs. Vygotsky and Luria (reported in Luria, 1979) hypothesized that, when the patient was climbing stairs, each stair represented a signal to which the patient had to respond in a conscious way. When Vygotsky placed pieces of paper on a level floor and asked the patient to walk across the room stepping over them, the formerly immobile patient was able to walk across the room unaided. In a series of studies, Luria and Vygotsky showed that a variety of techniques that induced subjects to regulate

² Vygotsky (1978, p. 61) referred to this form of experimentation as "experimental-developmental," an idea taken from Kurt Lewin. Borrowing from Heinz Werner, he declared: "Any psychological process, whether the development of thought or voluntary behavior, is a process undergoing changes right before one's eyes. The development in question can be limited to only a few seconds, or even fractions of seconds (as in the case of normal perception). It can also (as in the case of complex mental processes) last many days or even weeks. Under certain conditions, it becomes possible to trace this development.