

Vygotsky and the Social Formation of Mind

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To Mary

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CHAPTER 2

Vygotsky's Genetic Method

The fundamental claim in Vygotsky's genetic or developmental analysis is that human mental processes can be understood only by considering how and where they occur in growth:

We need to concentrate not on the *product* of development but on the very *process* by which higher forms are established . . . To encompass in research the process of a given thing's development in all its phases and changes—from birth to death—fundamentally means to discover its nature, its essence, for “it is only in movement that a body shows what it is.” Thus, the historical [that is, in the broadest sense of “history”] study of behavior is not an auxiliary aspect of theoretical study, but rather forms its very base. (Vygotsky, 1978, pp. 64–65)

Vygotsky contrasted his genetic approach with approaches that attempt to analyze psychological phenomena without regard for their place in development. He argued that such research can provide description but not explanation:

Following Lewin, we can apply [the] distinction between the phenotypic (descriptive) and genotypic (explanatory) viewpoints to psychology. By a developmental study of a problem, I mean the disclosure of its genesis, its causal dynamic basis. By phenotypic I mean the analysis that begins directly with an object's current features and manifestations. It is possible to furnish many examples from psychology where serious errors have been com-

mitted because these viewpoints have been confused. (ibid., p. 62)

The last sentence is particularly important because it reflects Vygotsky's concern with the problem of how assumptions about method influence the interpretation of psychological phenomena. He was arguing that misunderstandings often arise among researchers because they do not share assumptions about how a phenomenon should be investigated, and hence about what it *is*. For Vygotsky an essential aspect of the definition of a psychological phenomenon is its position in genetic transition. He assumed that the form of a phenomenon reflects the transformations it has undergone and the various factors that have entered into its development.

Vygotsky's point is not that psychological research which fails to use a genetic method is invalid or useless. Elsewhere in his writings he explicitly stated that such research can make an important contribution to the overall picture of psychology. However, he believed that without genetic analysis one can only describe certain aspects of psychological phenomena and cannot understand inner workings and causal dynamics. Perhaps more important for my present purposes, he believed that the failure to recognize the impact of method on the interpretation and definition of psychological phenomena can lead to confusion.

Vygotsky's major focus in genetic analysis was on developmental processes as they normally occur, but he also examined the effects of disruptions and interventions. Such procedures gave rise to several of his hyphenated terms that refer to variants of genetic analysis. In "comparative-genetic" analysis he was concerned with how the disruption of one of the forces of development would affect the evolution of overall practical and intellectual activity in humans. For example, Vygotsky studies the effects of deafness on the development of various mental functions. His approach to this issue is somewhat unique because he viewed deafness primarily in terms of how it changes a complex system of development. For this reason problems such as deafness, mental retardation, and blindness have always held great theoretical interest for Vygotsky (1981c) and his followers (for example, Leont'ev, 1948; Meshcheryakov, 1974).

Vygotsky also examined disruptions and interventions in genetic processes through the "experimental-developmental" method, which calls for an experimenter to intervene in some developmental process

in order to observe how such intervention changes it. Again the primary motivation for doing this is to observe genetic processes:

Our method may be called experimental-developmental in the sense that it artificially provokes or creates a process of psychological development. This approach is equally appropriate to the basic aim of dynamic analysis. If we replace object analysis by process analysis, then the basic task of research obviously becomes a reconstruction of each stage in the development of the process: the process must be turned back to its initial stages. (Vygotsky, 1978, pp. 61-62)

Vygotsky's claims about genetic analysis do not end with the general assertion that psychological processes must be studied in transition. In addition he had some specific ideas about the nature of development. First, he defined development primarily in terms of fundamental "revolutionary" shifts rather than steady quantitative increments. At these points of revolutionary dislocation, he argued, the very nature of development changes. Second, Vygotsky defined major transition points in development in terms of changes in the form of mediation utilized. Third, he claimed that the explanation of psychological phenomena must rely on an analysis of several different types of development, or what I shall term "genetic domains." Whereas genetic analysis is often limited to ontogenetic comparisons, Vygotsky included other types of comparisons, such as phylogenetic and sociohistorical, as well. As M. Cole and S. Scribner have pointed out, "when Vygotsky speaks of his approach as 'developmental,' this is not to be confused with a theory of child development. The developmental method, in Vygotsky's view, is the central method of psychological science" (1978, p. 7).

The Role of Qualitative Shifts

A fundamental feature of Vygotsky's genetic analysis is that he did not assume one can account for all phases of development by using a single set of explanatory principles. Instead, he argued that the critical issue is how to account for the changing relationships among multiple forces of development and their corresponding sets of explanatory principles. Thus he rejected accounts that are based on the assumption that development can be explained solely in terms of quantitative increments of some psychological unit, such as stimulus-response bonds. Instead of searching for any other single explanatory principle to account for development, he emphasized that at certain points in the emergence

of a psychological process new forces of development and new explanatory principles enter the picture. At these points, he argued, there is a "change in the very type of development" (Vygotsky and Luria, 1930, p. 4),¹ and so the principles which alone had previously been capable of explaining development can no longer do so. Rather, a new set of principles must be incorporated into the overall explanatory framework, resulting in its reorganization.

Some of the clearest expositions of this point can be found in Vygotsky's critiques of existing accounts of ontogenesis. He argued that approaches which rest on a single set of explanatory principles cannot provide an adequate interpretation of change. For example, he criticized P. P. Blonskii for attempting to account for all periods of ontogenesis on the basis of physiological principles, and he criticized other investigators for basing their entire analysis on another single dimension, such as sexual maturation:

These schemes do not take into account the reorganization of the process of development itself, by virtue of which the importance and significance of any characteristic is continually changing in the transition from one age to another. This excludes the possibility of breaking childhood down into separate epochs by using a single criterion for all ages. Child development is a very complex process which cannot be fully defined in any of its stages solely on the basis of one characteristic. (Vygotsky, 1972, p. 115)

The dominant tendencies in psychology that motivated Vygotsky's criticism of single-criterion theories were biological reductionism and mechanistic behaviorism. When considering the former, for example, he was quite critical of investigators' failure to recognize that biological principles cannot explain psychological phenomena beyond a certain level. He never disputed the role of biological factors in a complete account of ontogenesis, a point reflected in his statement that "scientific child psychology, of course, cannot be constructed otherwise than on a solid biological foundation" (1982a, p. 202).

However, he argued that beyond a certain point in development, biological forces can no longer be viewed as the sole, or even the primary, force of change. At this point there is a fundamental reorganization of the forces of development and a need for a corresponding reorganization in the system of explanatory principles. Specifically, in Vygotsky's view the burden of explanation shifts from biological to

social factors. The latter operate within a given biological framework and must be compatible with it, but they cannot be reduced to it. That is, biological factors are still given a role in this new system, but they lose their role as the primary force of change. Vygotsky contrasted embryological and psychological development on this basis:

The embryological development of the child . . . in no way can be considered on the same level as the postnatal development of the child as a social being. Embryological development is a completely unique type of development subordinated to other laws than is the development of the child's personality, which begins at birth. Embryological development is studied by an independent science—embryology, which cannot be considered one of the chapters of psychology . . . Psychology does not study heredity or prenatal development as such, but only the role and influence of heredity and prenatal development of the child in the process of social development. (1972, p. 123)

Vygotsky's argument against single-factor theories of development (theories that posit one major force of development and a single set of explanatory principles) was aimed primarily at biological reductionism and mechanistic behaviorism. His criticisms, however, also extended to representatives of another early twentieth-century school of psychology with which his ideas were much more compatible—Gestalt psychology. One of the places where this criticism appears most forcefully is in Vygotsky's introduction to a volume of Russian translations of K. Koffka's writings titled *Foundations of Mental Development* (1934). Here he argued that Gestalt psychology represented an advance over the atomistic mechanism of earlier stimulus-response theories, but that some of its proponents had slipped back into the mistake of advocating a theory that rests on a single developmental factor and a single explanatory principle. In this case the attempt was to account for all levels of psychological functioning on the basis of the notion of structure, or Gestalt, thereby overlooking the fundamental differences in explanatory principles that apply to different levels of psychological phenomena:

What is remarkable in [Koffka's] approach is the fact that he applies the structural principle not only to the intellectual actions of the human-like apes, but also to the lower animals in Thorndike's experiments. Consequently, *Koffka sees in structures some*

primary, primordial, and essentially primitive principles of behavioral organization. [According to him] It would be a mistake to think that this principle applies only to higher, or intellectual forms of activity. It is also present in the earliest and most elementary forms of development. This debate, says the author, confirms our understanding of the primitive nature of structural functions. If structural functions are really so primitive, they must appear in the primitive behavior that I call instinctual. We see how in refuting the theory of trial and error learning Koffka was led to the conclusion *that we can apply the structural principle equally to the higher intellectual actions of human-like apes, as well as to the training of lower mammals in Thorndike's experiments, and finally to the instinctual reactions of spiders and bees.* (Vygotsky, 1982a, pp. 245–246)

In sum, one of Vygotsky's basic assumptions about the development of psychological processes is that no single factor and corresponding set of explanatory principles can alone provide a complete account. Instead, multiple forces of development, each with its own set of explanatory principles, are involved. In this account, with the incorporation of a new force into the picture, the very nature of development changes.

The Role of Mediation in Qualitative Genetic Transitions

The major transition points in Vygotsky's genetic analysis are associated with the appearance of some new form of mediation. Depending on the genetic domain at issue, this mediation may be in the form of tools or signs. In some cases developmental transitions are linked with the introduction of a new form of mediation, whereas in others they are related to a transition to a more advanced version of an existing form of mediation. The former cases are associated with the qualitative transitions in Vygotsky's genetic analysis and will be my main concern here.

In the introduction to a volume on genetic analysis, Vygotsky and Luria explained that the scheme of their essays could be presented as follows:

The use and "invention" of tools in humanlike apes crowns the organic development of behavior in evolution and paves the way for the transition of all development to take place along new paths. It creates *the basic psychological prerequisites for the historical devel-*

opment of behavior. Labor and the associated development of human speech and other psychological signs with which primitives attempt to master their behavior, signify the beginning of the genuine cultural or historical development of behavior. Finally, in child development, along with processes of organic growth and maturation, a second line of development is clearly distinguished—the cultural growth of behavior. It is based on the mastery of devices and means of cultural behavior and thinking. (1930, pp. 3–4)

Vygotsky and Luria went on to argue:

All three of these moments are symptoms of new epochs in the evolution of behavior and indications of *a change in the type of development itself.* In all three instances we have thereby selected turning points or critical steps in the development of behavior. We think that the turning point or critical moment in the behavior of apes is the use of tools; in the behavior of primitives it is labor and the use of psychological signs; in the behavior of the child it is the bifurcation of lines of development into natural-psychological and cultural-psychological development. (Ibid., p. 4)

Thus major turning points, or revolutions in development, were connected with the appearance of new forms of mediation. However, Vygotsky did not view the introduction of a new form of mediation as resulting in a form of functioning in which factors that had previously governed psychological functioning no longer operate. The point is always that the explanatory framework must be *reformulated*, not discarded and replaced, in order to take into account a new factor and its interactions with existing factors. For example, with the introduction of psychological signs in social history, the biological constitution of the organism that has resulted from evolution continues to play an important role, but psychological functioning is now governed by biological constitution *and* sign use. Thus a more complex explanatory system—one that incorporates and integrates more than one factor—must now be used to account for mental functioning. Development can no longer be explained on the basis of principles that had formerly accounted for the genesis of psychological processes (in this case, principles of Darwinian evolution). Instead, development is now attributed to principles that incorporate the new factor that has entered the picture.

Elementary and Higher Mental Functions

A fundamental distinction that underlies Vygotsky's line of reasoning about qualitative transitions and the role of mediation is the distinction between "elementary" and "higher" mental functions (1978, p. 39). Vygotsky's general strategy was to examine how mental functions, such as memory, attention, perception, and thinking, first appear in an elementary form and then are changed into a higher form. In his approach a related distinction is that between the "natural" and the "social" (or "cultural") lines of development (1960, p. 47). Natural development produces functions in their elementary forms, whereas cultural development converts elementary into higher mental processes. It is the transformation of elementary into higher functions that Vygotsky usually had in mind when he spoke of how the nature of development changes.

As Cole (1985) has pointed out, the distinction between elementary and higher mental functions has had a long history in psychology. The general distinction arose in response to the need to separate psychological phenomena that can be found in both humans and animals from those that are unique to humans. The latter are viewed as the product of the sociocultural milieu in which humans live. For this reason Vygotsky (1960, p. 15) sometimes used the terms "cultural" (versus "natural") in place of "higher" (versus "elementary") when describing mental functions. Essentially, higher processes are assumed to represent a qualitatively new level of psychological functioning. Hence, it is impossible to account for higher processes by using the explanatory principles that apply to elementary functions.

The basic outlines of Vygotsky's version of the distinction between elementary and higher mental functions can be seen in the following comments on memory (here he employed the term "natural" instead of "elementary"):

A comparative investigation of human memory reveals that, even at the earliest stages of social development, there are two, principally different, types of memory. One, dominating in the behavior of nonliterate peoples, is characterized by the nonmediated impression of materials, by the retention of actual experiences as the basis of mnemonic (memory) traces. We call this *natural memory*, and it is clearly illustrated in E. R. Jaensch's studies of eidetic imagery. This kind of memory is very close to perception, because it arises out of the direct influence of external stimuli

upon human beings. From the point of view of structure, the entire process is characterized by a quality of immediacy.

Natural memory is not the only kind, however, even in the case of nonliterate men and women. On the contrary, other types of memory belonging to a completely different developmental line coexist with natural memory. The use of notched sticks and knots, the beginnings of writing and simple memory aids all demonstrate that even at early stages of historical development humans went beyond the limits of the psychological functions given to them by nature and proceeded to a new culturally elaborated organization of their behavior. Comparative analysis shows that such activity is absent in even the highest species of animals; we believe that these sign operations are the product of specific conditions of *social* development. (1978, pp. 38–39)

In this passage Vygotsky touched on four major criteria that he used to distinguish between elementary and higher mental functions: (1) the shift of control from environment to the individual, that is, the emergence of voluntary regulation; (2) the emergence of conscious realization of mental processes; (3) the social origins and social nature of higher mental functions; and (4) the use of signs to mediate higher mental functions.

The first characteristic that distinguishes elementary from higher mental processes is that the former are subject to the control of the environment, whereas the latter are subject to self-regulation. According to Vygotsky, "The central characteristic of elementary functions is that they are totally and directly determined by stimulation from the environment. For higher functions, the central feature is self-generated stimulation, that is, the creation and use of artificial stimuli which become the immediate causes of behavior" (ibid., p. 39). In his early work Vygotsky developed this idea by utilizing a Pavlovian model of stimulus-response connections in which higher mental functions involve an intervening link between an external stimulus and the organism's response. He argued that this reflects the fact that higher mental functions are "more complex genetically and functionally" (1960, p. 109). Pursuing this Pavlovian line of argument, he wrote:

The line common to both of these forms [that is, elementary and higher mental functions] is the stimulus-response relation. For one form the essential feature is the essentially complete determination of behavior by stimulation. For the other, the equally essential feature is *autostimulation*, the creation and use of artificial

stimulus-means and the determination of one's own behavior through their use.

In all of the cases we have examined, human behavior is uniquely defined not by the presence of stimulation but by the new or changed psychological situation that is created by humans themselves. The creation and use of artificial stimuli as auxiliary means for mastering one's own reactions is the foundation for the new form of determining behavior that distinguishes higher from elementary forms of behavior. (Ibid.)

The second, very closely related, criterion that distinguishes higher from elementary mental functions is their "intellectualization," or conscious realization. This criterion has recently been examined further by researchers such as M. Donaldson (1978). Vygotsky wrote of:

higher psychological functions whose basic and distinguishing features are intellectualization and mastery, that is, conscious realization and voluntariness.

At the center of development during the school age is the transition from lower functions of attention and memory to higher functions of voluntary attention and logical memory . . . the intellectualization of functions and their mastery represent two moments of one and the same process—the transition to higher psychological functions. We master a function to the degree that it is intellectualized. The voluntariness in the activity of a function is always the other side of its conscious realization. To say that memory is intellectualized in school is exactly the same as to say that voluntary recall emerges; to say that attention becomes voluntary in school age is exactly the same as saying . . . that it depends more and more on thought, that is, on intellect. (1934a, pp. 188–189)

The third criterion that characterizes higher, but not elementary, mental functions is their social origin and social nature. Vygotsky argued that "it is not nature, but society that above all else must be considered to be the determining factor in human behavior" (1960, p. 118). He was particularly interested in how social interaction in small groups or dyads leads to higher mental functioning in the individual. For him, "this transition from a social influence external to the individual to a social influence internal to the individual . . . is at the center of our research" (1960, p. 116).

The fourth distinguishing criterion is mediation. In Vygotsky's view voluntary control, conscious realization, and the social nature of higher

mental processes all presuppose the existence of psychological tools, or signs, that can be used to control one's own and others' activity. This leads once more to the conclusion that the notion of mediation is analytically prior to other aspects of Vygotsky's conceptual framework. According to Vygotsky, "The presence of *created*, along with *given*, stimuli is in our view the distinguishing feature of human psychology" (ibid., p. 109).

Thus voluntary control, conscious realization, social origins and nature, and mediation by psychological tools characterize higher mental functioning in Vygotsky's account. Elementary mental functioning, in contrast, is characterized by control by the natural environment, an absence of conscious realization, individual origins, and a lack of mediation by psychological tools.

Genetic Domains in Vygotsky's Approach

Vygotsky conducted most of his empirical research on elementary and higher mental functioning in the ontogenetic domain. His genetic analysis, however, cannot be equated with the study of child development. Indeed he specifically argued that, like other forms of development, ontogenesis can be properly understood only as part of a larger, integrated picture involving several genetic domains. In the introduction to their volume on development, Vygotsky and Luria wrote:

Our task [in this volume] was to trace *three basic lines* in the development of behavior—the evolutionary, historical, and ontogenetic lines—and to show that the behavior of acculturated humans is the product of *all three lines* of development, to show that behavior can be understood and explained scientifically only with the help of *three different paths from which the history of human behavior takes shape*. (1930, p. 3)

Phylogenesis

Vygotsky's writings on phylogenesis focus on a comparison between higher apes and humans. Drawing heavily on the research of W. Köhler (1921a, 1921b, 1925) on tool-mediated practical activity in chimpanzees and gorillas, he viewed tool use as one of the conditions that set the stage for the emergence of higher mental functions: "the ability to invent and use tools is a *prerequisite* for the historical development of

humans and already emerged in the zoological period of the development of our ancestors" (1960, p. 421).

Vygotsky's view that tool use is a *necessary but not sufficient* condition for the emergence of uniquely human higher mental functions allowed him to recognize the close phylogenetic affinity between apes and humans while insisting on the qualitative gulf that separates them. Much of his criticism of the psychological theories of his time was based on their failure to recognize the dual nature of this relationship. For example, he argued that one of the major weaknesses of reflexology and behaviorism was that these approaches implicitly attempted to reduce human behavior to animal behavior by trying to explain the former solely in terms of a "collection of habits worked out through the method of 'trial and error,' habits that are distinguished from the behavior of animals only in degree of complexity but not in principle, in qualitative terms" (ibid., p. 439). This form of reductionism results from a focus solely on the "necessary" portion of Vygotsky's formulation and a disregard for the "but not sufficient" portion.

Vygotsky also rejected the notion that the differences which separate the functioning of humans and apes could be explained entirely on the basis of phylogenetic change. This is not to say that he viewed such change as having nothing to do with the transition from apes to humans. He specifically noted that "within the confines of evolutionary theory itself one cannot ignore the fact of essential differences that exist between the human organism [and that of apes], in particular, differences in the human brain and the brain of the ape" (ibid., p. 440). However, in his view "the problem of 'animal-human' cannot be fully resolved on the basis of evolutionary theory. Evolutionary theory is only the prerequisite for the scientific construction of human psychology. It cannot encompass all of it. Human behavior must be examined from another perspective as well" (ibid., pp. 439-440).

The other perspective that Vygotsky had in mind involves forms of mediation and associated changes in social and psychological life. Vygotsky argued that the use of technical tools provides the foundation for socially organized labor activity. With the appearance of labor, the development of mental functioning is grounded in qualitatively new principles. According to Vygotsky, in order for the transformation from ape to human to be completed, "there must emerge a special, new form of adapting to nature, one that is alien to the ape—namely labor. As *Engels* showed, labor is the basic factor in the transformation of apes into humans. 'It is the first, basic condition of human existence.

This is so to such an extent that we must say in a well-known sense that labor created humans' " (1930, p. 50). This is part of the more general argument devised by Vygotsky and Luria about the relationship between types of development:

One process of development dialectically paves the way for the following and is transformed and crosses over to a new type of development. We do not think that it is possible to place all three processes [phylogenesis, social history, ontogenesis] along a single continuum. Rather, we propose that each higher type of development begins where the preceding one finishes and serves as its continuation in a new direction. This change in direction and in mechanisms of development by no means precludes the possibility of a connection between one process and another. Indeed, it presupposes such a connection. (ibid., p. 5)

Although Vygotsky's claims about the role of mediation by tools and speech in the development of labor can be traced to Marxist writings, especially those of Engels, he attached greater importance to the influence of semiotic phenomena than is typically found in Marxist approaches. Whereas Marx clearly emphasized the emergence of socially organized labor and production as the key to distinguishing humans from animals, Vygotsky considered the emergence of speech to be equally important. In this connection he made his most important and unique contributions but also departed in significant ways from the ideas of Marx and even Engels.

In the years since Vygotsky produced his account of the genesis of mental functions, disciplines such as primatology and physical and cultural anthropology have made advances that call into question some of his claims about phylogenesis. Of particular concern is his understanding of the relationship between phylogenetic change and the onset of culture.

Inherent in Vygotsky's account of organic evolution is the claim that it proceeds up to a point where culture can emerge, and then this evolution ceases. He envisioned virtually no overlap between the two types of genesis. Vygotsky's claims constitute what C. Geertz has termed a "critical point theory of the appearance of culture" (1973, p. 62). Such a theory views the emergence of the capacity for acquiring culture as a "sudden, all-or-none type of occurrence in the phylogeny of the primates" (ibid., pp. 62-63).

Like other scholars interested in the evolution of the human mind

(for instance, Habermas, 1979), Geertz argues that recent findings in physical anthropology make critical point theories untenable. The findings show that the transition from primates to humans occurred over a much longer time span (more than four million years) than had formerly been believed. Furthermore, during early phases of this period of hominidization, certain elements of culture were in evidence with Australopithecines, such as "simple toolmaking, sporadic 'hunting,' and perhaps some system of communication more advanced than that of contemporary apes and less advanced than that of true speech" (Geertz, 1973, p. 64). Hence the beginnings of culture can be traced to a time *preceding* the point where organic evolution ceased, a finding that undermines any critical point theory.

The recognition that biological and cultural development do not occur in isolation suggests that the biological substrate of mental processes may have emerged partially *in response to* cultural pressures. Geertz's reasoning on this issue indicates a need to revise certain aspects of Vygotsky's account of change in the phylogenetic domain. Instead of assuming that organic evolution and sociocultural development are isolated processes and that the latter got under way only after the former was completed, it now becomes essential to consider the ways that organic evolution may have been influenced by early forms of culture.

Thus Vygotsky's specific claims about the nature of transition points are no longer acceptable as stated. However, this observation does not call into question the general form of his argument. In particular, it does not weaken his claim that with the emergence of sociocultural activity the very nature of development changed.

Sociocultural History

As in the case of phylogenesis, Vygotsky's claims about sociocultural history were primarily theoretical and relied on the writings of others. Yet his ideas about this genetic domain played such a central role in the formulation of his approach that in the USSR it is often referred to as the "sociohistorical" or "cultural-historical" approach to the study of mind (Smirnov, 1975; see also Luria, 1971).

In accordance with the basic theoretical tenets that underlie his genetic analysis, Vygotsky assumed that a unique set of explanatory principles applies to the domain of sociocultural history. In particular, he stressed the difference between this and the phylogenetic domain: "the process of the historical development of human behavior and the process of its biological evolution do not coincide; one is not a con-

tinuation of the other. Rather each of these processes is governed by its own laws" (1930, p. 71). Such a claim raises the issue of what principles or laws apply to sociocultural history. If the principles of Darwinian evolution are posited as governing phylogenesis, what mechanisms and explanatory principles must be incorporated into an approach to account for sociocultural change?

Vygotsky, along with other Soviet psychologists, semioticians, and philosophers working in his tradition, considered this question to be central in any attempt to construct an account of human mental processes. The first step toward an answer is reflected in the following statement by A. A. Leont'ev:

The evolution of the species "homo sapiens" . . . has proceeded in some other different sphere than the biological, the species characteristics being accumulated not in the form of morphological changes, but in some other form. It has been a sphere of social human life, a form of the fixation of achievements of human activities in the social and historical experience of humanity . . . Man learns from the errors—and still more from the successes—of other people while each generation of animal can learn solely from its own . . . It is mankind as a whole, but not a separate human being, who interacts with the biological environment; therefore such laws of evolution as, for example, the law of natural selection become invalid inside the human society. (1970, pp. 123–124)

To account for the psychological correlates of sociohistorical change that Leont'ev has in mind here, one must invoke Vygotsky's distinction between "rudimentary" and "higher" mental functions. This dichotomy is not simply another pair of terms for the distinction between elementary and higher mental functions. Rather, it is a distinction between levels of development *within* higher mental functions. Vygotsky stated, "In our view rudimentary and higher functions are the extreme poles of one and the same system of behavior. They are its lower and higher points; they designate the boundaries within which all the levels and forms of higher functions are distributed" (1960, pp. 88–89).

It follows that rudimentary mental functions are characterized by the properties of higher (as opposed to elementary) mental functions. However, these properties, especially those of the mediational means, are manifested only in an early stage of the development of higher mental functions. In order to avoid confusion over terminology, I shall reserve the term "higher mental function" for the general type of func-

tion that contrasts with elementary mental functions. When dealing with developmental levels *within* higher mental functions, I shall employ the terms "rudimentary higher mental functions" and "advanced higher mental functions."

Clearly Vygotsky viewed rudimentary and advanced higher mental functions in terms of a genetic progression: "the structure of [advanced] higher forms appears in a pure form in these psychological fossils, in these living remnants of ancient epochs. These rudimentary [higher] functions reveal to us the previous state of all [advanced] higher mental processes; they reveal the type of organization which they once possessed" (1960, p. 108).

To assert that rudimentary and advanced higher mental functions exist in such a genetic relationship says nothing about the specific mechanism of change Vygotsky envisioned as connecting them. Not surprisingly, in order to understand Vygotsky's account of this mechanism one must once again turn to the issue of mediational means.

Sign mediation in sociocultural history is only one of several foci of analysis that Vygotsky could have chosen. As S. Scribner (1985) has noted, "all aspects of the historical progress of humankind were not of equal importance to Vygotsky. He was concerned with those forms of social life that have the most profound consequences for mental life. As we know, he thought these to lie primarily in the symbolic-communicative spheres of activity in which humans collectively produce new means for regulating their behavior" (p. 123). This focus is not necessarily the most obvious choice for someone trying to reformulate psychology from a Marxist perspective. It reflects the fact that Vygotsky gave a more central role to mediation, especially mediation by signs, than is found in most other attempts to formulate a Marxist psychology (compare Leont'ev, 1959; Seve 1978).

The basic metric by which Vygotsky measured sociocultural history was the emergence and change of psychological tools. This fact is evident in statements such as, "The behavioral development of humans is already development that is fundamentally governed not by the laws of biological evolution but by laws of the historical development of society. The perfecting of 'means of labor' and 'means of behavior' in the form of language and other sign systems that serve as auxiliary tools in the process of mastering behavior take on a primary role" (1930, p. 54).

In his account of the history of signs as mnemotechnical devices and

means of calculation as well as in his explanation of the relationship between thinking and speech, Vygotsky envisioned an overarching principle of development. This principle, which I shall label the *principle of decontextualization of mediational means*,² replaced those of Darwinian evolution after the emergence of culture. The decontextualization of mediational means is the process whereby the meaning of signs become less and less dependent on the unique spatiotemporal context in which they are used. A focus on the decontextualization of mediational means emerges repeatedly in Vygotsky's account of the sociocultural history of higher mental functions. For him it fulfilled the fundamental requirement of his genetic analysis that different explanatory principles apply to phases of development separated by a qualitative genetic transition.

An example of this concept can be found in Vygotsky's examination of quantitative operations, or calculation. He argued that the forms of counting observed in primitives is heavily dependent on the context; that is, counting relies on the perception of concrete objects and settings. This relationship does not preclude the ability to make fine distinctions between quantities, but the distinctions are based on judgments about concrete, perceptually present objects (objects in the specific context where signs are used).

In calculation, decontextualization is tied to the emergence of a number system in which a quantity can be represented independently of any concrete perceptual context. Indeed quantity can become an abstract object itself instead of a meaning tied to a set of concrete objects. With decontextualization it becomes possible to talk about two or three without specifying two or three *what*. Systematization makes it possible to account for the meaning of mathematical signs without relying on the context of their use or application. Thus two can be defined from *within* the number system as one plus one, three minus one, four minus two, and so on.

In collaboration with his student and colleague Luria, Vygotsky conducted a set of studies that bear on the issue of decontextualization of mediational means in the genetic domain of sociocultural history. These studies were carried out in Soviet Central Asia in the 1930s. Because of the academic and political debates in the USSR during the 1930s and 1940s (see Cole, 1979), the publication of the findings from this research was delayed for several decades (Luria, 1975b).

In the West this research would usually be considered cross-cultural. But from the perspective of a Vygotskian approach it would be more

appropriate to consider it "cross-historical," because Luria and Vygotsky were concerned with the influence of sociocultural institutions from one historical era on the cognitive activity of individuals whose socialization had occurred amid institutions from another era. Soviet Central Asia served as an ideal cross-historical laboratory because the population was in the midst of collectivization, a process in which they were rapidly introduced to practices and skills from societies of a different era as viewed from the perspective of historical materialism.

Luria and Vygotsky compared the performance of nonliterate subjects on a series of reasoning tasks with that of subjects who had recently acquired literacy skills. The tasks required them to do such things as categorize familiar objects or deduce the conclusion that follows from the premises of a syllogism. For example, in one task subjects were given pictures of a hammer, a saw, a log, and a hatchet and asked to say which three go together. Literate subjects were generally willing to say that the hammer, hatchet, and saw go together because they are all tools. That is, they grouped objects on the basis of abstract word meanings ("hammer," "saw" and "hatchet," but not "log," are hyponyms of "tool"). In contrast, the answers of nonliterate subjects indicated a strong tendency to group items on the basis of concrete settings with which they were familiar. Thus they might say that "the log has to be here too." Such subjects typically resisted suggestions by the experimenter that the hammer, hatchet, and saw could be grouped together—suggestions grounded in decontextualized word meanings and hierarchical relationships among them.

On the basis of his empirical findings Luria (1975b) concluded that some major differences exist between literate and nonliterate subjects in their use of abstract (that is, decontextualized) reasoning processes. His conclusions are similar to those of researchers such as D. R. Olson (1977, 1980) and L. F. M. Scinto (in press) about the effects of developing literacy in ontogenesis. Luria argued that subjects who had some experience in formal educational settings were willing to utilize decontextualized categories and assertions, whereas subjects with no such experience had much greater difficulty in doing so:

This tendency to rely on operations used in practical life was the controlling factor among uneducated and illiterate subjects . . . The somewhat more educated group of subjects employed categorical classification as their method of grouping objects even

though they had had only a year or two of schooling. For example, when we asked them which of the following objects go together . . . a glass, saucepan, spectacles, and a bottle . . . they immediately responded, "The glass, the spectacles, and the bottle go together. They are made of glass, but the saucepan is metal." (1979, p. 71)

In his study of the subject's performance on syllogistic reasoning tasks, Luria found results analogous to those from his categorization studies: "the process of reasoning and deduction associated with immediate practical experience dominates the responses of our nonliterate subjects" (ibid., p. 79). As in the categorization experiments, higher-level performance on syllogistic reasoning tasks required subjects to use language in a decontextualized manner.

Thus Luria and Vygotsky's studies revealed a major difference between literate and nonliterate subjects in their utilization of decontextualized mediational means, in particular, language. Literate subjects demonstrated a willingness and an ability to operate with linguistic objects and a linguistically created reality. They categorized objects, accepted premises, and derived conclusions strictly on the basis of linguistic means. Nonliterate subjects did not demonstrate such tendencies. Instead, they invoked nonlinguistic, practical experience in their reasoning.

When reviewing these results, Luria sometimes argued that the emergence of theoretical reasoning can be traced to subjects' participation in the institutions of a more advanced stage of social evolution. For example, when outlining characteristics of the population in Central Asia, he asserted that "as a result of societal changes and the cultural revolution, they were integrated into a culture in a very short time. Nonliteracy was stamped out, and elementary forms of individual economic life were replaced by a collective economy. These changes could hardly help but lead to the appearance of new forms of thinking" (1981, p. 207).

It is unclear whether it was literacy per se (that is, the ability to encode and decode written text) or a generally new social institutional framework that Luria considered responsible for the new forms of thinking that concerned him. Of course the two issues are closely connected, since literacy is usually learned in a specific social institution—formal schooling. However, as investigators like H. Mehan (1979) have argued, a student is also involved in learning a set of complex role relationships, general cognitive techniques, ways of approaching

problems, and the like. Therefore the question arises as to whether it is possible to separate the influence of the mastery of literacy from the influence of formal schooling.

In the past few decades several studies in anthropology and psychology have addressed this question. In some cases (for example, Cole and Scribner, 1974; Scribner, 1977; Scribner and Cole, 1981) this research was explicitly motivated by issues in Vygotsky's theoretical framework; in other cases (such as Goody, 1977) this influence is less explicit but the line of reasoning remains consistent with that proposed by Vygotsky. Much of the research has revealed and examined an implicit assumption in Vygotsky's argument, namely, that the acquisition of literacy automatically results in an increased decontextualization of mediational means. For example, Vygotsky's interpretation of the findings from his and Luria's studies in Central Asia is based on the assumption that in acquiring literacy, humans acquire the ability to utilize signs in less-context-bound ways. Indeed it could be said that they simply equated certain phases of decontextualization with literacy.

The problem is that this approach fails to recognize specific properties and types of literacy and the forms of abstraction that may derive from them. Vygotsky and his followers generally assumed that literacy is a homogeneous phenomenon that has a uniform impact on all aspects of higher mental functioning.

This set of assumptions has been questioned by Scribner and Cole (1981). Specifically, they have addressed two issues with major implications for a Vygotskian interpretation of the relationships among literacy, decontextualization, and higher mental functions. First, they explored the question of whether literacy can be equated with schooling. It may be that participation in the activities of formal schooling rather than literacy *per se* is what affects mental functioning. Although formal schooling and the acquisition of literacy are in most cases closely linked, it is possible to separate them conceptually and sometimes even empirically, thereby permitting concrete investigation of this issue. Second, Scribner and Cole examined the related question of whether it is possible to distinguish among forms of literacy that serve different functional roles in the life of the individual and society.

Scribner and Cole compared the performance of subgroups of Vai subjects in Liberia on cognitive tasks. Their choice of a research site was influenced by the fact that literacy and schooling are not always coterminous among the Vai. In addition to literacy in English, which is acquired in formal schooling settings, there exists literacy in Vai, "an

indigenous script, transmitted outside an institutional setting and having no connection with Western-style school" (1981, p. 19). The second form of literacy is used primarily for keeping personal records and for writing commercial correspondence. Finally, many of the Vai in this study had acquired literacy in Arabic, primarily for the purpose of reading, reciting, and memorizing the Qur'an. This third form of literacy is so tightly connected with religious text activities that Scribner and Cole argue that "for most informants in our sample, 'Qur'anic' is a more appropriate description of their literate activities than 'Arabic' " (ibid., p. 83).

Since some groups of Vai are versed in only one type of literacy, Scribner and Cole had the opportunity to "disentangle literacy effects from school effects" (ibid., p. 19) by comparing several subgroups: (a) subjects who had acquired English literacy in formal schooling settings; (b) subjects who had acquired Arabic literacy in instructional settings devoted to memorizing the Qur'an; (c) subjects who had acquired literacy in a Vai syllabic writing system through informal self-instruction; and (d) nonliterate.

Findings from these comparisons are particularly relevant because Scribner and Cole examined subjects' performance on categorization and syllogistic reasoning tasks similar to those used by Vygotsky and his colleagues. The results call into question Vygotsky's assumptions about the relationships among literacy, decontextualization, and higher mental functions:

Under conditions obtaining in Vai society, neither syllabic Vai script nor Arabic alphabetic literacy was associated with what are considered the higher-order intellectual skills. Neither literacy enhanced the use of taxonomic skills on any task designed to test categorization. Nor did either contribute to a shift toward syllogistic reasoning . . . nonschooled literacy, as we found and tested it among the Vai, does not produce general cognitive effects as we have defined them. The small and selective nature of Vai script and Arabic influences on cognitive performance precludes any sweeping generalizations about literacy and cognitive change. (1981, p. 132)

In contrast to the two forms of nonschooled literacy, literacy in English, acquired in a school setting, is associated with some types of decontextualization envisioned by Vygotsky. Scribner and Cole's most impressive finding is the tendency of English-literate subjects to formulate accurate, informative verbal accounts of task settings by relying

on general, relatively decontextualized meanings. They assessed this result by examining the subjects' use of linguistic means, such as general class and attribute expressions, to provide well-structured, informative explanations and justifications of the principles employed to carry out a task. On this basis they concluded that "schooling affects verbal explanations over and above any influences it may exert on successful execution of the task itself" (*ibid.*, p. 131).

Scribner and Cole did not find that their schooled, English-literate subjects consistently differed from other groups in their performance of the tasks themselves. They argued that this could be attributed to several causes, including the fact that many of their subjects had been out of school for a number of years. Hence they do not view their results as refuting the widely reported findings (for example, Rogoff, 1981) that increased schooling, when still ongoing or recently completed, is related to improved performance on categorization and abstract reasoning tasks. Their results do, however, call into question any claim that the effects of schooling are permanent. Following a line of argument similar to that of P. Tulviste (1978a), who has found that under certain circumstances schooling has only temporary effects on syllogistic reasoning, Scribner and Cole speculate that "even if we were to accept as a working proposition that school produces general changes in certain intellectual operations, we might have to qualify the conclusion to refer only to students, recent ex-students, or those continuing in schoollike occupations," (1981, p. 131).

A general claim about the impermanence of the effects of schooling and literacy is not necessarily inconsistent with Luria and Vygotsky's argument, since they never really addressed the issue. However, Scribner and Cole did not find *all* effects of schooled literacy to be impermanent. Rather, they found that their English-literate subjects did outperform other groups in providing informative verbal descriptions and justifications of their task activity. Superior task performance was also reported for the subgroup that had recently been in school. This combination of facts suggests that both task performance and verbal description of task performance may have improved as a result of schooled literacy, but that the former was relatively transient.

Vygotsky may have failed to recognize the difference between task performances and verbal description of task performance because he and Luria examined subjects who were in school or had recently been in school at the time of testing. When subjects are tested at this point, both verbal description and task performance are likely to be affected.

Hence the pattern of Luria and Vygotsky's empirical results was not conducive to their separating decontextualization of mediational means as reflected in subjects' explanations and higher mental functioning.

A second reason for their failure to recognize this distinction has to do with the empirical and analytic techniques used—specifically, with whether Luria and Vygotsky's experimental procedures measured the level of decontextualization, the level of higher mental functioning, or both. Vygotsky's approach encourages one to search for the relationships between such abilities rather than to isolate them. However, by using careful experimental and analytic procedures, Scribner and Cole were able to separate these two performance domains to some degree, and when they did so they were able to document differences in performance levels.

In summary, the research of Scribner and Cole calls into question Vygotsky's assumptions about the relationship between literacy and the decontextualization of mediational means on the one hand and between decontextualization and higher mental functioning on the other. Their findings indicate that it is not possible to draw a single dichotomy between people who are literate, schooled, capable of using decontextualized mediational means, and likely to use advanced higher mental functions on the one hand and people who cannot be characterized by any of these terms on the other. These relationships are more complex. It is possible to observe literacy in the absence of facility with decontextualized mediational means and advanced forms of higher mental functioning; it is possible to observe literacy with decontextualization but without a tendency to use advanced forms of higher mental functioning in actual task performance—and so on.

Given all these qualifications, Vygotsky's basic reasoning about change in the historical domain may seem no longer tenable. However, I would argue that his claims are ultimately based on the relationship between the decontextualization of mediational means and the emergence of advanced forms of higher mental functioning. While certain assumptions about the relationships among literacy, decontextualization, and higher mental functioning may not be accurate, decontextualization of mediational means as a general explanatory principle in the historical domain is not necessarily invalid.

A more serious challenge to Vygotsky's claims might appear to come from Scribner and Cole's argument about the effects of schooling above and beyond those of literacy. They suggest that "a practice account of literacy" may provide a more satisfactory approach than one based on

literacy alone. Such an account concerns the general question of how "socially organized activities may come to have consequences for human thought" (1981, p. 235). However, Scribner and Cole's argument still rests fundamentally on issues of mediational means and their decontextualization, because schooling itself is inherently concerned with the manipulation of mediational means (natural language, mathematical symbols, and the like). Hence any statistically identifiable schooling effect still is tied directly to the mediational potential of signs.

In their conclusions on the effect of schooling, Scribner and Cole are still arguing for a practice account of literacy, that is, a practice account grounded in mediational means. Thus their findings demonstrate that the important point is not simply whether one is literate by some basic criterion, namely, that one can encode and decode graphic symbols; rather, it is how one *uses* such literacy that governs decontextualization and any consequences for higher mental functioning.

Clearly the facts and assumptions underlying Vygotsky's account of the sociohistorical domain are open to question in light of recent research. After reviewing some of the criticisms and proposed revisions, however, it seems to me that Vygotsky's basic line of reasoning remains intact: that is, phylogenesis and sociocultural history must be kept distinct because fundamentally different sets of explanatory principles apply to each. In Vygotsky's terms the very nature of development changes when one moves from one genetic domain to the other. Furthermore, the explanatory principle that Vygotsky saw as applying to the sociohistorical domain is concerned with mediation. Specifically, genetic change in this domain is attributed to the decontextualization of mediational means.

Ontogenesis

Vygotsky and his followers are best known in the USSR and in the West for their studies of ontogenesis. They conducted most of their theoretical and empirical research in this domain partly because it can be observed over its entirety and is thus more "accessible" than phylogenesis and social history. In addition, their focus was motivated by Soviet psychologists' desire to play an active role in the construction of a new socialist society, a task that required a better understanding of child development and education.

Vygotsky's approach cannot be understood by examining his account of ontogenesis in isolation. At several points he utilized information and modes of reasoning derived from his analysis of other

genetic domains. This is not to say that he saw simple parallelisms between ontogenesis and other domains. Indeed he explicitly rejected arguments such as those in which ontogenesis is seen as recapitulating phylogenesis. His concern with multiple domains was not motivated simply by a desire to have several perspectives on one general process of development. Rather, he emphasized that the various domains involve different forms of development, each governed by its unique set of explanatory principles. This argument applies no less to ontogenesis than to phylogenesis and social history.

The main criterion that distinguishes ontogenesis from other domains for Vygotsky is the fact that ontogenesis involves the simultaneous, interrelated operation of more than one force of development. While this domain has the advantage of being observable in its entirety, it has the disadvantage of precluding the study of any developmental force in isolation. Unlike phylogenesis, for example, where one can study the operation of a single set of explanatory principles apart from those that govern other genetic domains, ontogenesis necessarily involves the simultaneous operation of more than one developmental force. Vygotsky saw it as involving both a "natural" and a "social" or "cultural" line of development:

The cultural development of the child is characterized first by the fact that it transpires under conditions of dynamic organic changes. Cultural development is superimposed on the processes of growth, maturation, and the organic development of the child. It forms a single whole with these processes. It is only through abstraction that we can separate one set of processes from others.

The growth of the normal child into civilization usually involves a fusion with the processes of organic maturation. Both planes of development—the natural and the cultural—coincide and mingle with one another. The two lines of change interpenetrate one another and essentially form a single line of sociobiological formation of the child's personality. (1960, p. 47)

This simultaneous operation of natural and cultural forces led Vygotsky to reject any claims about close parallels between ontogenesis and other genetic domains. For instance, he rejected the notion that ontogenesis recapitulates social history because social forces function in relative isolation in the latter. One member of the Vygotskian school, Tulviste (1978b), has formulated this point as follows: "In contrast to ontogenesis, the natural maturation of the brain does not play a role in the course of historical development (Vygotsky, 1960; Luria, 1971).

The natural course of the historical development of cognitive processes is the historical development of society" (p. 83). Such differences led Vygotsky to argue that a complete genetic analysis of human psychological processes calls upon the investigator to integrate facts from several domains. While ontogenetic studies form an essential part of this analysis, there are certain inherent limitations in such studies because more than one developmental force is always in operation. The way to deal with this problem is to supplement the findings from one genetic domain with those from others. For example, when investigating certain problems, one can utilize data from ontogenesis but one must also "turn to phylogenesis, where the two lines (the natural and the cultural) are not united and intermingled, in order to unravel the complex knot that we find in child psychology" (1960, p. 39).

Vygotsky's distinction between natural and cultural lines of development is closely linked to the distinction between elementary and higher mental functions. The natural line of development is generally associated with elementary mental functions, and the cultural line with higher mental functions. Furthermore, natural development is explained primarily on the basis of biological principles, whereas cultural development is attributed to principles that apply to mediational means, including the principle of decontextualization.

Vygotsky's claim about the intermingling of lines of development presents a major challenge for the investigator concerned with ontogenesis. While the two lines of development cannot be empirically separated, this domain is nonetheless regarded as properly conceptualized in terms of the interaction and mutual transformation of separate forces. The forces are not viewed as being additive or as simply supplanting each other in importance, as in the transition from phylogenetic to sociohistorical change. Instead, they operate in tandem to form a qualitatively unique explanatory framework.

Vygotsky's multidomain strategy avoids two fundamental forms of reductionism that often emerge in ontogenetic research. First, it avoids the pitfall of assuming that all aspects of cognitive development can be explained on the basis of principles devised to account for biological phenomena. With regard to contemporary theories, this is a point where Vygotsky's approach may be seen to differ from Piaget's. Rather than assuming that a single set of explanatory principles, such as adaptation and equilibration, can account for all aspects of cognitive development, Vygotsky argued that such principles need to be incor-

porated into a larger explanatory framework that deals with sociocultural phenomena as well.

The second form of reductionism that Vygotsky was striving to avoid might be termed "cultural reductionism," because it rests on the premise that human psychological processes can be explained solely on the basis of mastery and internalization of symbolic means or sociocultural practices. Such accounts often ignore biological forces and other constraints involved in ontogenesis. Vygotsky clearly rejected what I am calling cultural reductionism, a fact reflected most clearly in his critique of idealism and subjective psychology.

Vygotsky's explanation of the dynamics of ontogenesis rests on the assumption that the natural line of development may operate in relative isolation in early childhood but is soon integrated with the cultural line in a process of "emergent interactionism" (Kohlberg and Wertsch, in press). According to this position the explanatory principles that account for development must be *derived* from those that apply to the two separate forces of development, but they cannot be *reduced* to the principles that apply to either one in isolation.

Whereas Vygotsky's theoretical approach clearly led him to view ontogenesis in terms of interacting forces of development, his empirical psychological research often focused on only one of these forces as if it could be studied in isolation. Such inconsistencies have been noted by others. For example, V. V. Davydov and L. A. Radzikhovskii (1985) have argued that one must distinguish between "Vygotsky the methodologist"³ and "Vygotsky the psychologist."

In his claims about the fusion of natural and cultural forces in ontogenesis, resulting in a "single line of sociobiological formation," Vygotsky's empirical procedures strayed from his theoretical dictates in several ways. The first inconsistency concerns what might be termed "direction of influence." Whereas Vygotsky's theoretical statements call for a "fusion" in which "both planes of development . . . coincide and mingle with one another" (1960, p. 47), in practice he focused almost exclusively on the ways in which cultural forces transform the natural line of development. That is, he tended to view the natural line as providing "raw materials" that are then transformed by cultural forces. He said virtually nothing about how changes in the natural line of development might affect cultural forces.

I would argue that his focus on only one of the two possible directions of influence is an echo of the relationship Vygotsky saw between

the phylogenetic and sociocultural domains. Without falling into any full-fledged form of recapitulationism, he did seem to see a parallel between the necessary but not sufficient conditions provided by phylogenesis on the one hand and the functioning of the natural line of development in ontogenesis on the other. That is, he assumed that natural forces cease to play an active role in ontogenetic change after an early period and that cultural forces thereafter take on the leading role. This is not to say that constraints from the natural line are no longer in effect. Just as in phylogenesis, the natural line in ontogenesis is viewed as providing necessary but not sufficient conditions for the operation of social forces. However, the natural line itself is seen as no longer providing a major independent source of change. Rather, it contributes a static framework within which cultural forces can operate. In contrast, Vygotsky claimed that cultural forces evolve and continue to play an active role in ontogenesis. Such a line of reasoning is reflected in his statement that "organic maturation plays the part of a *condition* rather than a motive power of the process of cultural development, since the structure of that process is defined by *outward* influences" (1929, p. 423).

This problem is closely tied to a second one, namely, the claim that during early phases of ontogenesis natural and cultural forces operate completely independently. Vygotsky made this statement at a time when little was known of the complex social and cognitive functioning of infants. Only in the years since his death have investigators such as J. Piaget (1952), T. G. R. Bower (1974), Bruner (1975a), and S. Sugarman (1983) made the major advances in infant research that inform present theoretical discussions. As a result, Vygotsky's claims about early phases of natural and cultural lines of development in ontogenesis are unsophisticated by today's standards. This has led to several critical comments on his idea that the two lines of development are completely separate during infancy. In a review of his theoretical approach Leont'ev and Luria point out that "after all, even in children at the very earliest ages mental processes are being formed under the influence of verbal social interaction with the adults who surround them. Consequently these mental processes are not 'natural'" (1960, p. 7). In the USSR M. I. Lisina (1974, 1978) and her colleagues (such as Vetrova, 1975; Elagina, 1977) conducted a series of studies in which they examined the early influence of social forces on memory and other mental processes. One implication of their studies is that the social and

natural line of development are intertwined from the earliest phases of ontogenesis.

The two problems I have outlined in Vygotsky's account of ontogenesis are relatively minor, in that it would be possible to make appropriate revisions in his approach by incorporating updated theoretical and empirical findings. The third way in which Vygotsky failed to implement his theoretical dictates about the natural and cultural lines of development also derives largely from the fact that at the time he was writing, little was known about the complex and rapid psychological development of infants. In this case, however, the problem is more serious because it calls into question one of the basic terms in his argument: the natural line of development.

Vygotsky never was clear about what he had in mind when dealing with natural development. His treatment of this issue leaves many unanswered questions, largely because in his concrete research Vygotsky focused almost exclusively on social or cultural development. He tended to analyze the natural line only to the extent necessary to begin a discussion of sociocultural factors. For example, in a fifty-page paper on the development of attention in ontogenesis, Vygotsky (1981c) spent only two pages on a general discussion of the differences between natural and social development and devoted the rest to social development.

What Vygotsky did say about natural development was often simply borrowed from other researchers' findings. For example, he tried to incorporate results of phylogenetic research into his account of ontogenesis by using findings from research on higher apes' problem-solving activity (as in Köhler, 1921a, 1921b, 1925). His assumption was that apes' problem-solving activity approximates what elementary mental functioning would be in human ontogenesis if this functioning were not influenced by cultural development. It would remain only an approximation since Vygotsky saw a phylogenetic gap separating apes from humans. However, it supposedly could provide insight into "pure" elementary mental functioning in humans. Employing such findings from comparative psychology is a reasonable procedure for devising an account of elementary mental functioning, but it constitutes only the first step in understanding the natural line of development in human ontogenesis. The fact that Vygotsky stopped at this point in outlining elementary mental functioning is largely responsible for the weaknesses in this aspect of his approach.

Criticisms of Vygotsky's superficial treatment of natural development usually fall into one of two basic categories: (a) the very notion of "natural" is unclear in Vygotsky's writings; and (b) his extreme emphasis on social development results in an explanatory system in which principles from the natural line in reality play no role.

At first glance, in addressing the natural line of development Vygotsky seemed to be speaking of changes in organic, especially neurophysiological, mechanisms or processes. On some occasions, however, he seemed to be concerned with natural *behaviors* or *activities* rather than with neurophysiological mechanisms. This inconsistency is reflected in the fact that he used several constructs, some relating to neurophysiological phenomena and others to patterns of behavior. For example, in his writings he contrasted "elementary" and "higher functions" (1978, p. 39), "low and higher forms of behavior and thinking" (1960, p. 15), "organic development" and "cultural development" (*ibid.*, p. 47). In some cases the first member of the dichotomy clearly referred to neurophysiological mechanisms or processes; in others, Vygotsky was concerned with patterns of behavior or forms of activity. The latter are presocial and hence are not mediated by sociohistorically evolved sign systems, but they are not necessarily reducible to neurophysiological principles.

Vygotsky's apparent confusion derives from the fact that he did not always clearly equate the development of natural or elementary processes with neurophysiological development. Yet at some points he seems to have done so. For example, when considering early phases in the development of attention, he wrote: "We call this entire period in the development of the child the period of natural or primitive development. This term is appropriate because the development of attention in this period is a function of the general organizational development of the child—above all, the structural and functional development of the central nervous system" (1981c, p. 193).

The trouble with his approach is that it fails to account for the development of natural processes that arise from the organism's experience with the external, physical world. Such development, which is based neither on neurophysiological maturation nor on social factors, has been the focus of much research over the past several decades. In particular, the research of Piaget (1952) on the ontogenesis of intelligence in humans has amply demonstrated that Vygotsky's notion of natural development must be revised to include factors other than organic maturation. The revision would not drastically alter Vygotsky's

fundamental line of reasoning about the development of higher mental functions, but it would change some of his ideas about the early stages of this development. Specifically, it would mean that the natural line of development could not be explained solely on the basis of organic maturation. Instead, a larger set of explanatory principles would have to be employed, including those proposed by Piaget for the development of sensorimotor intelligence.

Of course the very notion of emergent interactionism precludes the possibility of reducing Vygotsky's approach to Piaget's. Even if one expands the notion of natural development to encompass Piaget's analysis of sensorimotor intelligence, the two approaches still differ because of Vygotsky's assumption that a fundamentally new set of explanatory principles is required when the child enters into certain levels of social life in a culture.

Besides the confusion in Vygotsky's discussion of natural development, critics argue that because he neglected this line of development so completely, he really viewed thinking as the product of social factors alone. For example, S. L. Rubinshtein (1946) asserted that Vygotsky's account of word meaning elevated the social processes involved in speech to the role of sole creator of thinking. Most investigators have not carried out analyses as detailed as Rubinshtein's, but implicit in many accounts of Vygotsky's ideas is the notion that social processes alone somehow create psychological processes.

At least in principle Vygotsky clearly rejected this interpretation. For example, in the course of a discussion of mental retardation he stated, "We shall begin with the basic tenet that we have managed to establish in the analysis of higher mental functions. We saw that this tenet consists of acknowledging the natural foundations for cultural forms of behavior. Culture creates nothing; it only alters natural data in conformity with human goals" (1960, p. 200). Even though such statements reflect Vygotsky's methodological position on ontogenesis, they are seldom evidenced in his empirical studies.

Although Vygotsky's account of natural development is a weak link in his overall line of reasoning, I would not suggest that the weakness can be rectified by abandoning this aspect of his approach. Indeed I would argue that his theoretical approach could not remain intact if his claims about emergent interactionism were dismissed. His overriding interest in mediation may have led him to underemphasize the role of natural forces in ontogenesis, but his methodological argument cannot be reduced to one in which cognitive growth can be explained

solely in terms of the acquisition of psychological tools. Such a "modification" would result in an approach that either rejects the notion that natural forces play a role in ontogenesis or completely isolates natural from cultural forces of development. Either alternative would lead to an incomplete and fundamentally inaccurate account of human mental processes according to Vygotsky's theoretical dictates.

Vygotsky's account of the dynamics of the ontogenetic domain can be summarized as follows. Development is viewed in terms of the relationship between natural and cultural forces. Although Vygotsky's theoretical statements suggest that the two lines enter into a relationship of mutual transformation, his concrete proposals and empirical research consistently reveal another interpretation, one that assumes a unidirectional influence: specifically, the practical intelligence of the natural line of development is transformed as a result of coming into contact with aspects of the social line. Even if one were to devise such a unidirectional account of the dynamics between these two forces, one would have to specify what is transformed as well as what transforms it. Vygotsky's failure to do the former is perhaps the most serious weakness in his account of ontogenesis. Recognition of this problem, however, does not mean that his approach can be reduced to one involving a single line of development. Instead, it seems most reasonable to say that this is a point at which his empirical research failed to explore an issue that is an essential part of his methodological framework.

While Vygotsky himself failed to conduct empirical research on the natural line of development and its relationship to sociocultural forces, other investigators have conducted studies relevant to these issues. Examples include the studies of H. Ginsburg and his associates on the development of mathematical skills (Ginsburg, 1982; Ginsburg, Posner, and Russell, 1981; Ginsburg and Allardice, 1984). Indeed certain aspects of their research are explicitly motivated by Vygotsky's theory.

In their studies they distinguish among three cognitive systems of mathematical knowledge or functioning. First, they identify "System 1" functioning, which "does not involve counting or other specific information or techniques transmitted by culture" (Ginsburg, 1982, p. 191). Because it is not transmitted by culture, it is termed "natural," and because it emerges independently of formal schooling, it is termed "informal." In System 1 functioning Ginsburg includes such things as the perception of more as described by A. Binet (1969) and skills for

making judgments about one-to-one correspondence, equivalence, and seriation as outlined by Piaget.

The description of System 1 functioning corresponds with Vygotsky's notion of the natural line of development and elementary mental functioning: performance is closely tied to the concrete context and involves no culturally developed mediational means. Indeed, Vygotsky wrote of "natural arithmetic" in the ontogenetic domain: "The first stage [in the child's arithmetic ability] is formed by the natural arithmetical endowment of the child, that is, the operation of quantities before the child knows how to count. We include here the immediate conception of quantity, the comparison of greater and smaller groups, the recognition of some quantitative group, the distribution into single objects where it is necessary to divide, and so on" (1929, p. 427).

The next level of mathematical skills is Ginsburg's approach involves "System 2" functioning, which is characterized as "informal" because it still emerges outside of formal instructional settings, but also "cultural" because it utilizes socioculturally evolved sign systems (that is, number systems). The fact that some sort of sociocultural sign system is now introduced means that System 2 mathematical functioning cannot be subsumed under Vygotsky's heading of elementary mental functions. Hence System 2 skills are part of higher mental functioning. However, when compared with "System 3" functioning, the level at which the sign system is utilized in System 2 skills is rudimentary. The minimal utilization of the sign system in mediating mental functioning is attributable to the fact that it is still being used in a context-bound way. Numbers are employed to count concrete objects rather than serving as abstract objects to be operated on in their own right; that is, decontextualization has occurred only to a minimal degree. Given this set of characteristics of System 2 mathematical skills, I would argue that they correspond to rudimentary higher mental functioning in Vygotsky's theoretical framework.

The final type of mathematical functioning identified by Ginsburg, System 3, is characterized as "formal" because it is taught systematically in formal schooling environs, and "cultural" because it involves socioculturally evolved sign systems and is "transmitted by social agents" (1972, p. 192).

Ginsburg's description of System 3 skills is very similar to Vygotsky's notion of advanced higher mental functions. Socioculturally evolved mediational means are involved and are used in relatively decontext-

tualized ways. The tendency toward decontextualization is reflected in a comment by Ginsburg and Allardice about "explicitly stated mathematical principles" (ibid.). Such principles are typically formulated to apply across various contexts, that is, they are context independent.

Ginsburg and his associates have made ontogenetic, cultural, and subcultural comparisons in their investigation of the three types of mathematical skills. They begin with the assumption that "certain System 1 skills, particularly those studied by Piaget, are extremely widespread and may be found in members of diverse cultural groups" (Ginsburg, 1982, p. 192). On the basis of cross-cultural research such as that reported by P. Dasen (1977), Ginsburg speculates that "perhaps System 1 skills are an universal as basic language ability" (1982, p. 192).

In their empirical study of System 1 skills Ginsburg and his associates found no significant main effects for race, social class, or family type. They did, however, find significant main effects for age and type of problem. The effect for problem type reflected a difference between "misleading" problems on the one hand and "regular" and "random" problems on the other. The misleading problems could not be solved by using the concrete (that is, context-bound) perceptual mechanisms of elementary mental functioning. Rather, some experience with sign mediation was necessary to avoid being misled by information about length. A similar point has been made by Bruner and P. Greenfield (1966).

Perhaps the most important aspect of Ginsburg's findings for a Vygotskian account of elementary mental functioning is the performance difference attributable to age. Ginsburg's results indicate that this functioning continues to develop after infancy. He and his colleagues do not state whether they think this development is a result of organic maturation or of some other developmental mechanism. Whatever the mechanism, this finding provides another example of the weakness inherent in Vygotsky's account of elementary mental functioning. It indicates that such functioning develops in ways and in accordance with principles that he did not foresee.

The absence of performance differences in elementary mental functioning attributable to class, race, and family type is not surprising from a Vygotskian point of view. Even if Vygotsky's approach were expanded to include experience with the physical environment as well as organic maturation, there is no reason to expect sociocultural factors to influence this performance.

When they examined System 2 and System 3 skills, Ginsburg and his associates found some effects for schooling. In the System 2 skill of mental addition they also found that unschooled adults from the Ivory Coast had developed informal procedures that differed from those of schooled adults (both in the United States and on the Ivory Coast) but were just as efficient and accurate. In the System 3 skills involved in complex, written addition problems, Ginsburg and his associates observed cross-cultural differences for children during the early school years, but these differences disappeared with increased exposure to formal schooling. If one considers System 2 and System 3 skills to be rudimentary and advanced forms of higher mental functioning, respectively, this pattern of results is to be expected. In particular, the tendency toward decontextualization that is encouraged in schooling is reflected in the groups' progress on System 3 tasks.

Thus Ginsburg and his colleagues have managed to identify and measure forms of mental functioning associated with the natural and social lines of development. When it comes to the issue of how the two lines of development are *interrelated* in ontogenesis, however, the problems left unexamined by Vygotsky remain unresolved today. In particular, there is still no specification of the role of the natural line (System 1 in Ginsburg's framework) in the development of the cultural line. Ginsburg asserts that System 1 skills "might serve as a solid foundation for mathematical education" (that is, for the development of System 3 skills), but this connection is nowhere explicated or empirically examined. This does not constitute a criticism of Ginsburg's research, since his major concern was not to explain the interrelationships among forces of development, but it does reflect the fact that contemporary investigators of cognitive development still have not resolved the problem of integrating natural and sociocultural phenomena into an overarching theoretical framework.

During the past few years another group of researchers headed by G. Saxe (1981, 1982a, 1982b; Saxe and Posner, 1983) has independently conducted a series of studies on numeration and arithmetic reasoning that also bear on Vygotsky's ideas about the two lines of development and the decontextualization of mediational means. Like the research conducted by Ginsburg, these studies involve cross-cultural as well as ontogenetic comparisons. Much of the interest of Saxe's research stems from the fact that he studied the use of an unusual body-part numeration system. This system is employed by the Oksapmin, a

remote and recently contacted group in Papua, New Guinea. Saxe (1982a) explains that "the standard Oksapmin numeration system differs markedly from the Western system . . . To count as Oksapmin do, one begins with the thumb of one hand and enumerates 27 places around the upper periphery of the body, ending on the little finger of the opposite hand" (pp. 159–160). Vygotsky could not have known about this specific numeration system, since the Oksapmin were first contacted by Westerners in 1938. However, similar numeration systems exist elsewhere in New Guinea and were reviewed by Vygotsky in his account of the emergence of higher mental functioning in the sociocultural domain (Vygotsky and Luria, 1930).

A major concern in Saxe's research is the transition from "premediational" to "mediational" uses of number terms. This transition has been the topic of several ontogenetic studies. For example, R. Russac (1978) and Saxe (1977) have noted that when young children (three to four years of age) are asked to make quantitative comparisons of two sets of objects, they may count the sets but do not use the derived information to make their comparisons. Other investigators (such as B. Schaeffer, J. Eggleston, and J. Scott, 1974; R. Gelman and C. Gallistel, 1978) have shown that even though they have counted a set, young children may not use the last numeral to identify its sum. The studies have identified a general tendency among young children to manipulate the forms of sign systems but not to incorporate them appropriately into higher mental functioning. As Saxe (1982a) points out, such findings have important implications: "If this process of change from a phase in which number terms are used in a 'premediational' fashion to a phase in which they are used in a mediational fashion can be shown to be a general one, it would represent a way in which historical forms of knowledge become interwoven with the construction of concepts and problem-solving strategies during ontogenesis" (p. 162).

Saxe's investigation of ontogenetic change among the Oksapmin yielded results that were in many ways similar to those found among Westerners. Based on a series of observations, he reports that "young Oksapmin children counted, though often in response to a probe question, but typically did not base their comparisons of reproductions on the products of their counting, whereas older children did" (1982a, pp. 162–163). Saxe also notes that young children performed as well as older ones when the set size was quite small. This finding, however, reflects what Vygotsky termed elementary mental functioning or what

Ginsburg terms System 1 functioning and hence does not require the use of mediational means.

In Vygotsky's terminology these results indicate that certain aspects of a sociocultural sign system can emerge before becoming intertwined with the practical reasoning associated with the natural line of development. The findings accord with Vygotsky's claims about the independent growth of the two lines of development before they enter into emergent interaction. This set of claims raises the further issue of whether the sign system reflected in premediational functioning is really the same as that reflected in mediational functioning. Vygotsky's claims about the nature of decontextualization suggest that the sign systems at these two points may not be the same.

The developmental progression from premediational to mediational functioning is not the only point at which the issue of decontextualization arises in Saxe's research. It also appears in connection with the unique properties of the Oksapmin numeration system. Since this system employs body parts as sign forms, it uses concrete objects, which have an everyday significance of their own, in a system for manipulating potentially abstract mathematical means. This fact raises the possibility of confusion over the meanings of sign forms. In order to be employed consistently and appropriately in mathematical reasoning, the meanings of these forms must be separated or abstracted from their properties as concrete body parts.

Saxe has reported results from some studies on this issue. In one study he examined Oksapmin children's understanding of numeration systems that employ the same body parts as their own but that assign them different numerical values:

Children were told that people in their own village count from the right to the left sides of their bodies . . . however, in a village over the mountains, people count from the left to the right side of their bodies . . . Children were then told a story about two men counting sweet potatoes, one from the child's hamlet and the other from a faraway hamlet over the mountains. The child was told that both men counted to the same body part, one beginning at the right thumb, the other beginning at the left thumb . . . The child was then asked whether the two men counted to the same number of sweet potatoes or whether they counted to a different number of sweet potatoes (1982a, p. 163).

Saxe found that during the stage of premediational functioning young Oksapmin children "compared body parts with respect to their physical

similarity rather than with respect to their values as summations" (1982, pp. 163–164). In contrast, older children considered the value of a body part in terms of its role in numeration, regardless of its physical properties. This observation reflects the process of decontextualization of mediational means: sign values are increasingly defined on the basis of their position in a context-free system of numerical values rather than their concrete properties and contexts.

As with Ginsburg's research, Saxe's studies are most informative about the decontextualization of mediational means. Of particular interest is the problem caused by the use of body parts as sign forms in the Oksapmin numeration system. Saxe's findings reveal a special type of difficulty that may be encountered in decontextualization. In addition, the studies of Saxe and others on the developmental progression from premediational to mediational functioning are relevant to Vygotsky's approach to higher mental functions, particularly his claim about the independent appearance and emergent interactionism of mediational means and the natural line of development.

The research studies reviewed here focus on mathematical skills, but the points I have made apply generally to the development of higher mental functioning, with its associated sociocultural mediational means. Ginsburg's studies reveal that progress has been made in identifying and assessing elementary mental functions as well as rudimentary and advanced forms of higher mental functions. However, in the end there has been little progress in answering the question of how the natural and cultural lines of development are interrelated in ontogenesis. The study of cognitive development remains at the stage of viewing the natural line of development as providing the necessary but not sufficient conditions for cultural development. Saxe's research makes it possible to extend the account of decontextualization by considering a case where sign forms are connected with concrete objects in a unique way.

Microgenesis

In addition to phylogenesis, sociocultural history, and ontogenesis, one other genetic domain—what I shall term "microgenesis"—occasionally played a role in Vygotsky's analysis. His understanding of microgenesis is most apparent in his comments on experimental procedures in psychology. He argued that when conducting laboratory studies, the investigator should at least be aware of the microgenetic processes involved in the formation and execution of a psychological process. Although he did not go into great detail on this issue, he

seems to have recognized two basic types of microgenesis. As J. V. Wertsch and A. Stone (1978) have pointed out, the distinction he used is similar to the distinction H. Werner (1957, 1961) made between types of microgenetic experiments.

The first type of microgenesis identified by Vygotsky concerns the short-term formation of a psychological process. The study of this domain requires observations of subjects' repeated trials in a task setting. Thus one could think of it as a very short-term longitudinal study. In a chapter on methods in psychology, Vygotsky (1978) argued for the need to include this type of microgenetic analysis in psychological investigation. He pointed out that by ignoring this form of genetic transition, learning and experimental studies often fail to utilize what may be the most interesting data they generate. The data emerge when an investigator is trying to train a subject to criterion before beginning the "real observations":

Uniformity was sought, so that it was never possible to grasp the process in flight; instead, researchers routinely discarded the critical time when a reaction appears and when its functional links are established and adjusted. Such practices lead us to characterize the responses as "fossilized." They reflect the fact that these psychologists were not interested in complex reactions as a process of development. (1978, p. 68)

The second type of microgenesis is the unfolding of an individual perceptual or conceptual act, often for the course of milliseconds. As in the first case, Vygotsky probably derived his notion from Werner's writings in which two kinds of "genetic experiment" were proposed along these lines. In the final chapter of *Thinking and Speech* (1934) one can see Vygotsky utilizing this type of microgenesis in his account of speech production. He was concerned with the transformations involved in the movement from thought to speech utterance. His argument on this issue has had an important influence on Soviet neurolinguists, such as Luria (1975a, 1981) and T. V. Akhutina (1975, 1978).

Vygotsky's genetic method may be summarized in a few fundamental tenets:

1. Human mental processes must be studied by using a genetic analysis that examines the origins of these processes and the transitions that lead up to their later form.

2. The genesis of human mental processes involves qualitative revolutionary changes as well as evolutionary changes.
3. Genetic progression and transitions are defined in terms of mediational means (tools and signs).
4. Several genetic domains (phylogenesis, sociocultural history, ontogenesis, and microgenesis) must be examined in order to produce a complete and accurate account of human mental processes.
5. Different forces of development, each with its own set of explanatory principles, operate in the different genetic domains.

Vygotsky posited Darwinian natural selection as the developmental force that operates in the phylogenetic domain. According to him, phylogenesis provides a necessary but not sufficient condition for the emergence of *Homo sapiens*. In addition to evolutionary changes in organic structure, especially the brain, the sociocultural phenomena of labor and communication are required to create human beings. The point at which these sociocultural phenomena begin to emerge and create human beings is the point at which the very nature of development changes, in that the explanatory principles which account for change are now sociocultural rather than biological.

Vygotsky's account of this transition must be revised in light of recent advances in primatology and physical anthropology. As researchers such as Geertz have pointed out, critical point theories that assume a sudden, sharp onset of sociocultural change are no longer tenable. Rather, it is now recognized that certain early forms of culture were developed while organic evolution was still under way. This fact raises the possibility that cultural practices exerted some influence on organic change, a possibility that holds particular interest for a Vygotskian approach with its emphasis on mediation and communication.

When one turns to the sociocultural domain, a different force of development with its unique set of explanatory principles is seen to be at work. The locus of change shifts from organic evolution governed by natural selection to the stage of mediational means. Mediational means (tools and signs) make possible the transmission of culture, but more important for Vygotsky's approach is the fact that they provide the mechanism for sociocultural change. Whereas the appearance of mediational means, especially tools, marks the emergence of socio-historical forces of change, it is now the decontextualization of me-

diational means, primarily signs, that provides the possibility of sociocultural change. In Vygotsky's writings this decontextualization is linked to the transition from rudimentary to advanced forms of higher mental functioning.

Just as Vygotsky's account of phylogenesis and the emergence of sociohistorical change should be updated in light of recent advances in social science, his account of sociocultural change stands in need of revision. In this case the research of Scribner and Cole on the psychology of literacy is particularly useful. Specifically, the claims made by Vygotsky and Luria about the role of literacy in the decontextualization of mediational means need to be modified. Instead of viewing literacy as a single, undifferentiated phenomenon with a uniform impact on higher mental functioning, Scribner and Cole have shown that there are differing types of literacy with differing cognitive consequences. In particular, these results suggest that the real focus of Vygotsky's claims about literacy and decontextualization may be literacy as it emerges in formal schooling contexts.

Turning to Vygotsky's account of ontogenesis, one sees that he posited a fundamentally new kind of genetic dynamic. Unlike the first two, where a single developmental force served as the focus of Vygotsky's analysis, he conceptualized change in the ontogenetic domain in terms of two interacting forces of development: natural and sociocultural forces of change. Vygotsky argued that although these two lines cannot be empirically separated during most phases of ontogenesis, this domain can be properly understood only by analytically separating them in order to examine their mutually transformatory powers.

Vygotsky's concrete research on ontogenesis did not live up to the dictates of his methodological argument, hence the need to distinguish Vygotsky the methodologist from Vygotsky the psychologist. Vygotsky's account of natural development left much to be desired. He failed to provide a detailed account of the changes in this line of development and of how these changes influence cultural development. However, this issue is actually quite complex and has not been adequately addressed to this day in studies of cognitive development. Instead of focusing on the emergent interactionism suggested by his theoretical framework, Vygotsky's concrete investigations of ontogenesis focused on the unidirectional impact of cultural forces on the natural line of development, in particular, on how the decontextualization of mediational means produces ontogenetic change in higher mental functioning.