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L.S. Vygotsky and A.R. Luria: Foundations of Neuropsychology

I would like to start this paper with one memory. In 1970, when I completed my dissertation, L.S. Tsvetkova, my scientific adviser, decided to show the manuscript to Alexander Romanovich Luria. He made a single correction: in one place, concerning the detailed development of neuropsychological principles, he crossed out his name and wrote “L.S. Vygotsky.” Because I had mentioned the elaboration of those principles in detail, I found it more appropriate to mention Luria’s name; however, Luria had a different opinion on this issue. Being a young, resolute author, I put both names in the manuscript.

I share this reminiscence not only to illustrate Luria’s faithfulness to his friend and mentor but also to ask several questions: If Luria was right, what road led Vygotsky to a comprehensive development of the principles of neuropsychology? What is the basis of this new field? What is the general theoretical system that incorporates these principles? The answers to these questions are important with respect to the history of our science, and the strategic phases of neuropsychological development in general.

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The significance of the entire body of neuropsychology must be taken into account when studying specific issues; in addition, there is a need to return to the basics of this discipline with every step forward in the development of the science.

Unfortunately, we do not have materials available to provide all of the answers to these questions. Specifically, I have in mind the loss of valuable documents, records of clinical studies conducted by Vygotsky, which were once preserved by one of his students, L.S. Geshelina, but have been lost. Colleagues of my generation still remember clinical cases of patients discussed by Luria, however, the recorded tapes were never published. Furthermore, Luria's large archive has been only partially rediscovered. I remember that in connection with the publication of the paper [The Problem of Consciousness] by L.S. Vygotsky (published in 1968/1982b), Alexander Romanovich told A.A. Leontiev that he [Luria] still had many such materials. Besides, there are archives of R.E. Levina, N.G. Morozova, and other disciples of Vygotsky. Another problem in this research has been almost a total absence of scientific-historical research documenting the cooperation between Vygotsky and Luria. Radzikhovskii and Khomskaia (1981), A.A. Leontiev (1990), and Khomskaia (1992) only touched upon this issue in short publications. Despite these circumstances, I will attempt to answer the questions mentioned above, using materials that are available and known.

“Consciousness as a Problem of the Psychology of Behavior”

The starting point will be the article [Consciousness as a Problem of the Psychology of Behavior] written by Vygotsky in 1925 (Collected Works, vol. 1, 1982b; English edition—hereinafter E.—1997). In this work, Vygotsky gave an initial framework of psychology, and, correspondingly, the first very general understanding of the correlation between the social and biological genesis of the human psyche or mind.

Let us try to follow Vygotsky's logic, which he constructed in dispute with contemporary theories. According to Vygotsky, human behavior may be described in terms of conditioned and unconditioned reflexes; however, this description excludes the specifics of human behavior. The term "reflex" equally applies or refers to both animals and human beings, and is sufficient for the former but incomplete for the latter. The initial formula by Vygotsky is the following: human behavior differs from animal behavior because of human social and historical experience, and the "doubling experience." In using this term, Vygotsky, following Karl Marx, implied that a human can consciously represent (in mind) the goal of his/her action. Vygotsky referred to the epigraph of his article, where he cited Marx's words about the difference between the worst architect and a bee.¹ Vygotsky had to meet the challenge of explaining how a reflexive response may become a qualitatively different phenomenon, a phenomenon that could allow the "doubling experience" to occur. Following N.N. Lange and C. Sherrington in the discussion of physiological data, Vygotsky, with deep insight, identified the role of a circular response and proprioceptive links in the organization of behavior. Later, these ideas were transformed into an understanding of the functional system; however, at that point Vygotsky took yet another step forward based on the concept of "reflexes." Vygotsky addressed the fact that the mechanism of a reflexive reaction may vary specifically when triggered by the stimulus of a word. Because a verbal stimulus may be reproduced, that is, become a response, and that response may in turn become a stimulus, the reflexes become reversible.

In the whole multitude of stimuli one group clearly stands out for me, the group of social stimuli coming from people. It stands out because I myself can reconstruct these stimuli, because they very soon become reversible for me² and thus determine my behavior in *another way* from all others. They make me comparable to another, [and] identical to myself. The source of social behavior and consciousness lies in speech in the broad sense of the word. (Vygotsky, 1982b, p. 95; cf. E., 1997, p. 77)

Further in the text, Vygotsky added the following: “We are conscious of ourselves because we are conscious of others and by the same method as we are conscious of others, because we are the same vis-à-vis ourselves as others are vis-à-vis us” (Vygotsky, 1982b, p. 96; E., 1997, p. 77).

Eventually, Vygotsky transformed his initial formula: historical-social experience and consciousness represent specific phenomena of the broadly understood social experience, all characterized by the “doubling experience.” Later, he drew the following conclusion: “Thus, consciousness as a specific category, as a special type of being, is not found. It proves to be a very complex structure of behavior, in particular, the doubling of behavior, just as this is said of labor in the words used as the epigraph” (Vygotsky, 1982b, p. 98; E., 1997, p. 79).

In a 1925 manuscript, Vygotsky concluded that consciousness is social interaction, placed inwards. Thus, he approached the initial resolution of the problem of the “brain versus consciousness” phenomenon by emphasizing the role of a word in the formation of the human mind. For labor to become labor, a mechanism of identifying the goal of the act is required, which can be created only with the help of a reproduced material sign, specifically, a word.³

On the way to the psychological systems: Instrumental method

After he identified the nucleus of his theory, new objectives opened before Vygotsky. In his *zone of proximal development*, we find an instrumental method and the idea of internalization, a development of the concept of a psychological (i.e., functional) system, and a new approach to verbal meaning. However, the first item on his agenda was the experimental testing of the role of a word (i.e., a sign, a psychological tool) in the organization of human behavior. Vygotsky first outlined a genetic line of research: each member of the “triangle”—Vygotsky, Luria, and Leontiev—had the task of

studying a special function (at that time the functions were considered separately from each other). And only later did his plan include a study of the pathological disintegration of mental functions.

An extensive summary of the results of the genetic line of research is found in Vygotsky's and Luria's book, *Studies on the History of Behavior: Ape, Primitive, and Child*, completed no later than the summer of 1929, and published in 1930 (the second, cited edition 1993). The chapter "Child" written by Luria proved to be the most complicated part. In keeping with the authors' intentions, Luria was supposed to emphasize "a bifurcation in the course of a child's behavioral development into natural-psychological and cultural-psychological development" (Vygotsky and Luria, 1930/1993, p. 20; cf. E., p. 37). Within that perspective, Luria described the data provided by other authors as well as by Vygotsky's group concerning the development of such functions as perception, memory, attention, speech, and thinking. In particular, Luria considered the phenomenon of egocentrism in the thinking and speech of a child, singled out by Jean Piaget, as a manifestation of natural-psychological development. Without noticing the contradiction, Luria mentioned some of Vygotsky's new experiments demonstrating a planning function of egocentric speech (cf. Vygotsky and Luria, 1930, p. 141). Somewhat later in the text, with reference to a comparison made by Karl Marx about the difference between an architect and a bee, Luria wrote the following:

[T]o a large degree we owe this enormous superiority of intellect over instinct to the mechanism of inner speech. . . . Turning from outside inward, speech formed the most important psychological function, representing the external world within us, stimulating thought, and, as several authors believe, also laying the foundation for the development of consciousness. (Vygotsky and Luria, 1993, p. 196; E., 1993, p. 206)

Vygotsky was aware of the contradictory character of his own theory (as well as the interpretation given by Luria). In a letter dated July 23, 1929, Vygotsky wrote to A.N. Leontiev, speaking about the inconsistency demonstrated by Luria: "This is not a

personal fault of A.R. [Luria], but of the entire ‘epoch’ of our mentality . . .” (Vygodskaia, 1994, p. 14). The theory of using a sign as a psychological tool without a new theory of internalization, in the absence of the understanding of a system and dynamic organization of mental functions, fails to consistently explain the genesis of the child’s behavior. That was the conclusion that Vygotsky came to one year later. Before we elaborate on this issue, let us briefly discuss the history of the second, “pathological” line of his research.

Planning this line of research, in 1926, Vygotsky joined the Clinic of Nervous Diseases, where Luria was already working. In one of the versions of his scientific autobiography, Luria wrote:

L.S. Vygotsky and I came to this Clinic in the middle of the 1920s, driven, perhaps, by different reasons. I came in the hope of finding material for the analysis of behavioral disintegration in patients with neuroses [using a method of associative motor reactions—T.A.]; L.S. Vygotsky had broader interests associated with the psychology of an abnormal childhood, on the one hand, and the role of speech in human behavior, on the other. (Luria, n.d. [1966?], p. 103)⁴

Vygotsky was the first to display an interest in the organic damage of the brain, and he involved Luria as well. Initially, they both addressed speech impairment (aphasia), and later, motor disorders such as Parkinson’s disease and other clinical syndromes. The results of these researches allowed them to make one more step in understanding of the psychological mechanisms of human behavior.

“On Psychological Systems”

The results of both genetic and pathological lines of research were summarized by Vygotsky in a lecture “On Psychological Systems” presented on October 9, 1930, at the Clinic of Nervous Diseases (Vygotsky, 1982b, pp. 109–31; E., 1997, pp. 91–107). In that work he presented a “ladder of facts” with the goal of formulating an idea that “he had been considering for several years

but feared to express”—the concept of interfunctional connections:

In each stage of development and in each form of loss, we see a unique and changing set of relations. My report is dedicated to this very theme. Its main (and extremely simple) idea is that in the process of development, and in the historical development of behavior in particular, it is not so much the functions that change as we studied before, (and it was our mistake), and it is also not so much their structure or the line of their development that changes. What is changed and modified are rather the relationships, the links between the functions. New constellations emerge which were unknown in the preceding stage. That is why intrafunctional change is often not essential in the transition from one stage to another. It is interfunctional changes, the changes of interfunctional connections and the interfunctional structure that matter. We will call the development of such new flexible relationships between functions *a psychological system*, giving it all the content that is usually attached to this, unfortunately, too broad concept. (Vygotsky, 1982b, p.110: cf. E., 1997, p. 92) [Some corrections have been made to the translation to make it closer to the original text—T.A.]

In that way, Vygotsky formulated one of the principles of modern neuropsychology—the principle of the system structure of the higher psychological functions. I use the phrase *higher psychological functions* because Vygotsky often did this in Russian, with the following thoughts in mind:

We must not view mind as [consisting of] special processes which supplementarily exist on top of and alongside the brain processes, somewhere above or between them, but as the subjective expression of the same processes, as a special side, a special qualitative characteristic of the higher functions of the brain. Through abstraction the mental process is artificially separated or torn from the integral psychophysiological process within which it only acquires its meaning and sense. The insolubility of the mental problem for the older psychology resided to a large extent in the fact that because of its idealistic approach the mental was torn from the integral process of which it forms a part. It was ascribed the role of an independent process existing alongside and apart from the physiological processes. . . . We thus arrive at the recognition of unique psychophysiological unitary processes. These represent the higher forms of human behavior, which we suggest calling

psychological processes, in contradistinction to mental processes and analogously with what are called physiological processes. (Vygotsky, 1982b, p. 137; E., 1997, p. 113)

During the presentation in 1930, Vygotsky discussed not only the principle of the system structure of functions but also the principle of the social genesis of the higher psychological functions. In this context he developed (possibly, for the first time), the new understanding of internalization:

When we studied the processes of the higher functions in children we came to the following staggering conclusion: each higher form of behavior enters the scene twice in its development—first as a collective form of behavior, as an interpsychological function, then as an intrapsychological function, as a certain way of behaving. We do not notice this fact, because it is too commonplace and we are therefore blind to it. (Vygotsky, 1982b, p. 115; E., 1997, p. 95)

This understanding allowed Vygotsky not only to discover specific psychological mechanisms of the social genesis of mental functions but also to consider the consequences pertaining to the problem of localization. Let us elaborate on this issue in more detail. Having cited Jean Piaget's observations that the debate precedes the inner dialogue—thinking—Vygotsky drew the following conclusion: "each higher function was thus originally shared between two persons. It was a reciprocal psychological process. One process took place in my brain, the other in the brain of the one with whom I have an argument (Vygotsky, 1982b, p. 115; E., 1997, p. 96).

He stated that the brain substrate of mental processes is represented by complex systems of the entire brain apparatus, which also represents an intricate cooperation between certain zones. However, that answer did not completely satisfy him, he wanted to know how this cooperation appeared. Vygotsky turned to his recent experiments on the reorganization of motor activities in patients with Parkinson's disease. He used external signs (e.g., pieces of paper scattered over the floor) as an aid for a patient to make a step, which resulted in the following hypothesis: "The Parkinsonian patient establishes a connection between different points of his brain through a sign, influencing himself from the

periphery” (Vygotsky, 1982b, p. 129; E., 1997, p. 106). Thus, in establishing various psychological systems, Vygotsky pointed out the significance of “extracerebral” links (which is how he labeled these links in 1934). This entire evolutionary teaching was based on the knowledge that a function leads to the formation of an organ, that is, it induces structural changes in the body, but Vygotsky formulated a radically new idea. He spoke on a new form of evolution with reference to human beings only:

The whole question is *what* it is in the brain that physiologically corresponds to thinking in concepts. In order to explain its development in the brain, it suffices to assume that the brain contains the conditions and possibilities for a combination of functions, a new synthesis, new systems which do not at all have to be structurally engraved beforehand. (Vygotsky, 1982b, p. 128; E., 1997, pp. 104–5)

If translated into fashionable modern concepts, that can mean the following: the evolution of animals implies a change in *hardware*, that is, a material repository of programs; the development of man implies mostly a change in *software*, a flexible, easily modified system of programs.

How did Vygotsky explain such a shift? According to him, the formation of a psychological system undergoes three stages:

First, an interpsychological stage—I order, you execute. Then an extra-psychological stage—I begin to speak to myself. Then an intrapsychological stage—two points of the brain that are excited from outside [that are externally stimulated—T.A.] have the tendency to work in a unified system and turn into an intracortical point. (Vygotsky, 1982b, p. 130; E., 1997, p. 106)

Let us consider these three phases. The first phase is common to man and higher animals, and lies at the basis of any training. The second phase is manifested by speech addressed to oneself, reproducing a command of another person, that is, a reversible reflex, or the possibility of the “doubling experience.” The second—mental—experience, estranged from the immediate connections with the body and the environment, may be rebuilt and reprogrammed, which occurs during the third phase.

In his paper “On Psychological Systems,” Vygotsky developed two principles of neuropsychology: social genesis and the systemic structure of the higher psychological functions. He also outlined the initial contours of the principle of the dynamic localization of functions. Vygotsky pointed out the following: “Therefore, one of the fundamental ideas in the area of the development of thinking and speech is that there can be no fixed formula that determines the relationship between thinking and speech and is suitable for all stages of development and forms of loss” (Vygotsky, 1982b, p. 110; E., 1997, p. 92).

He further developed the embryo of this idea in the six chapters of [*Thinking and Speech*]. The idea of the seventh chapter “Thought and Word” would come only later. It was the idea that the meaning of words develops not only in phylogenesis and ontogenesis, but in actual genesis as well, that is, during the movement from thought to word and back. So, in 1930 the principle of dynamic organization and localization of the higher psychological functions appeared in Vygotsky’s “zone of proximal development.” This principle was closely linked with the new understanding of the process of speech production (i.e., the actual genesis of speech).

In the 1930 lecture, Vygotsky not only summarized the results of his work, but also set up a new experimental problem, which included research on the human psychological systems and their fate. He began to look for new methods of research by reevaluating methods that had been applied earlier. The inner logic of Vygotsky’s research, together with the outer events, directed his attention not only to studies of psychological functions in normal subjects (first of all, language acquisition and processing [*Thinking and Speech*]) but also to defectology and medicine.

Elaboration of the idea of psychological functions

At this point in time, many doors of various pedagogical establishments in Moscow were closed to Vygotsky and his disciples,

and the atmosphere at the Institute for Experimental Defectology worsened as well. The situation in medicine turned out to be somewhat different; therefore, Vygotsky and his disciples were invited to Kharkov to work in the newly established Psychoneurological Institute. A.N. Leontiev, A.V. Zaporozhets, L.I. Bozhovich, and later A.R. Luria found jobs in Kharkov. Vygotsky hesitated to join them, staying in Moscow. Still, he traveled regularly to Kharkov, and, in 1931, he entered the Kharkov Medical Institute, having passed exams for three years of study. During this period, Luria resumed his studies at the Medical Institute in Kharkov and started to work in the clinic. In 1932, he compiled a description of the experiments he had conducted with Vygotsky six years earlier, analyzing the reorganization of motor activities in patients with Parkinson's disease (Luria, 1963, pp. 159, 181). In 1933, Luria presented a lecture on the correlation between the structure of the nervous system and behavior (cf. E.A. Luria, 1994, p. 86). In order to create adequate tests for aphasia he turned to linguistics. In his letters from Kharkov to L.P. Linchina, his wife-to-be, Luria wrote the following: "My aphasia patient is happy and he will make me happy as well" (May 18, 1933); a month and a half later (June 26), he wrote again:

I am completing my studies of aphasia patients and trying to convince them that the brother of the father is not the same as the father of the brother. . . . Currently we came across lots of very interesting material: cases of agnosia, agraphia, postnatal psychoses with aphasia . . . we are drowning in an abundance of the rarest cases. I am thoroughly enjoying medicine: I am spending time with Vygotsky to study pathophysiology, and, of course, thinking about you. (E.A. Luria, 1994, pp. 80–81)

In parallel with clinical observations and reading of works by psychophysicists and neuropathologists, Vygotsky continued to work with children and teenagers. He summarized clinical research data in manuscripts and lectures on the issues of developmental psychology and defectology. These works dealt mostly with comparisons of the data on behavioral development and pathological

disintegration. Now Vygotsky formulated the principle of the dynamic (chronogenic) localization of functions, which explained the possibility of changing localization of functions in both ontogenesis and actual genesis. Thus, in the article "Pedology of the Adolescent," written in 1930–31, Vygotsky, following E. Kretschmer (1928), wrote the following:

Thus, the mechanisms that control our behavior at earlier stages of development . . . do not disappear entirely in the adult; they are included as an auxiliary, implementing mechanism in the composition of the more complex synthetic function. Within it, they act according to laws other than those that control their independent life. But when the higher function disintegrates for any reason, the subordinate factors preserved within it are emancipated and begin again to act according to the laws of their primitive life. . . . Disintegration of the higher function also means, in a conditional sense, of course, a kind of return to a genetically prior stage of development. (Vygotsky, 1984a, p. 166; E., 1998, pp. 124–25)

Vygotsky applied these ideas when comparing processes of formation and pathological disintegration of the system of concepts occurring in the teenage period with those observed in cases of amnesic aphasia. Based on the data accumulated by A. Gelb and K. Goldstein (1920, 1924), as well as his own observations, Vygotsky believed that in these cases: "the complex unity, which is the basis of the concept, and the complex of judgments, which is applied in it as a certain synthesis, disintegrate" and one can see "the dropping of the word to a genetically earlier function in which it was a sign of a complex or a family name" (Vygotsky, 1984a, p. 175; E., 1998, p. 131).

Later, Luria would resort to the same explanation of an impairment of naming in semantic aphasia (cf. Luria, 1947), and contemporary research has also confirmed that interpretation (cf. Akhutina, 1994).

Vygotsky justified the principle of the dynamic localization of functions with his own new observations in his last lecture "The Problem of Development and Disintegration of Higher Mental

Functions” (1960). The presentation was made on April 28, 1934, at a conference at the Institute of Experimental Medicine where Professor N.I. Grashchenkov had invited Vygotsky and his group to work. (While there, on May 9, Vygotsky suffered a throat hemorrhage, and died a month later.)

In that presentation, Vygotsky contrasted the consequences of a similar functional defect of visual agnosia, or central blindness, observed in adults and compared with that in children. On the basis of his own observations and references to the data provided by K. Goldstein (1924) and O. Peztl (1928), Vygotsky demonstrated that in the first case, this defect led to minor damage limited purely to the visual sphere; and, in the second case, it resulted in major underdevelopment of all cognitive functions.

Vygotsky’s last work, namely abstracts submitted to the First All-Ukrainian Psychoneurological Congress, was entitled “Psychology and the Theory of the Localization of Mental Functions” (1982b, pp. 168–74; E., 1997, pp. 139–44). This work may well be considered the “neuropsychological testament” that Vygotsky left behind. In it, Vygotsky elaborated on the three major theoretical statements that he suggested should be considered as working hypotheses used to interpret clinical facts related to the problem of localization. Vygotsky examined the issue regarding the “function of the entire brain and its parts.” He formulated the statement: “It [research] demonstrates, first, that no specific function is ever connected with the activity of one single brain center. It is always the product of the integral activity of strictly differentiated, hierarchically interconnected centers” (Vygotsky, 1982b, p. 170; E., 1997, p. 140). That statement formed the basis of the principle of the systemic organization of the higher psychological functions (cf. Luria, 1969, pp. 21, 34). Vygotsky differentiated the function of the brain as a whole (background) and the function of the part (figure), writing:

At any rate, it can be considered an established fact that the relations between the functions of the whole and the functions of the part are essentially different depending on whether the figure in brain activity

is represented by higher mental functions and the ground by the lower ones, or whether, the reverse, the figure is represented by the lower functions and the ground by the higher ones. (Vygotsky, 1982b, 170 E., 1997, p. 141)

Differentiation between the figure and the background is conceptually close to the understanding developed by N.A. Bernshtein (1947) concerning the leading and background levels of the organization of movement. An example, cited by Vygotsky, alludes to the automatic or nonautomatic flow of a process, emphasizing conceptual proximity. That similarity was not accidental (cf. Zinchenko and Lebedinsky, 1981; Leontiev, 1982b, E., 1997), insofar as both authors based their understanding on data pertaining to the evolution and ontogenesis of the brain (Vygotsky, 1984a, pp. 284–91; E., 1998, pp. 216–31), and shared the thesis that: “Thus, we see that the brain preserves in itself in a spatial form the documented temporal sequence of development of behavior, and a disintegration of complex single functions allows us to penetrate into the history of their development” (Vygotsky, 1984a, p. 164; E., 1998, p. 123).

That understanding was closely linked with the second Vygotsky’s conclusion concerning the chronogenic localization of functions. The dynamic localization takes place due to (1) the modification of the structure of functions through ontogenesis, and (2) the possibility of implementing the same function on various levels in actual genesis. These ideas form the core of the second principle of neuropsychology—the principle of dynamic organization and localization of functions (cf. Luria, 1969, pp. 35–36).

In the third thesis, Vygotsky postulated a new principle of localization of functions in the human brain as compared to the animal’s brain. It refers to the specifically human brain areas (frontal and parietal associative zones) and to the specifically human types of activity—“higher forms of speech, cognition, and action” (Vygotsky, 1982b, p. 174; E., 1997, p. 143). Vygotsky emphasized that “extracerebral links” play a significant role in the process of formation of these functions: “This history demonstrates

that initially all these functions operate in intimate connection with external activity and only later on, as it were, disappear inward and change into inner activity” (Vygotsky, 1982b, p.174; E., 1997, p. 143). This argument, taken from ontogenetic development, is complemented by the conclusion drawn from Vygotsky’s observations in pathology. “Research into the compensatory functions that develop in these disorders also shows that the objectification of a disturbed function, that is, bringing it outside and changing it into external activity, is one of the basic roads in the compensation of disorders” (Vygotsky, 1982b, p. 174; E., 1997, p. 143). That statement of Vygotsky about a social way of forming higher psychological functions during one’s lifetime, while being closely related to the principle of localization, was acknowledged in neuropsychology as a principle of social genesis and a mediated structure of the higher psychological functions (Luria, 1966, pp. 59–60; Luria, 1969, pp. 34–35).

The debate around inheritedness

Because ongoing discussions still strongly contest whether the higher psychological functions are inherited or acquired, in particular, related to the ability of speech, I would like to elaborate in more detail the view expressed by Vygotsky. Specific human functions are developed within the social experience. In the process of formation, the functional structure and brain organization undergo transformations with a simultaneous modification of their reliance upon inborn biological mechanisms: Initially, these functions are determined by biological mechanisms, but in a later phase, the functions assume control over biological mechanisms.

One of Vygotsky’s notes in 1932, related to psychophysiological problems, was most remarkable. There, he criticized earlier theories for their lack of reference to the historical development of consciousness, formulating his point of view in the following way:

The unity of psychophysiological processes and the dominance of the psychic moment; study of *psychological* processes; the “peak”

approach to a psychophysiological problem . . . *The most important thing*: A possibility of a new progression introduced by consciousness, of a new transformation of psychophysiological processes, new links, and a new type of development of functions, in particular, *historical* with the modification of interfunctional links—a case impossible in the context of organic development—psychological systems. For example: a word and its meaning. (Vygotsky, 1982b, p. 66)

Let us elaborate on that example a little more. Speaking about the formation of the system of concepts and the basis of categorical thinking, Vygotsky wrote:

The new structure of generalization is first formed by the child on the basis of only a few concepts. These concepts are usually newly acquired, through instruction, for example. When this new structure has been mastered, the child can reconstruct or reform the structure of all previously existing concepts. (Vygotsky, 1982c, pp. 280–81; E., 1987, p. 231)

Vygotsky called this transformation “self-movement inherent in the development of concepts” (Vygotsky, 1982c, p. 277; E., 1987, p. 229). He seemed to have come very close to Jean Piaget’s idea (1979) concerning the role of self-organization:

Self-regulation, the roots of which are obviously of organic origin, is a prerogative of living and mental processes, and beyond that, its effect has a huge advantage in that it can be monitored immediately. That is why we ought to search for a biological interpretation of cognitive structures through self-regulation, and not merely through heredity. (Piaget, 1979, p. 60)

We may assume that Vygotsky would have agreed with this idea; however, he would have emphasized that one form of self-organization might differ from another. He would also have noted an “antihistorical tendency” in Piaget’s statement concerning phases of psychogenesis:

(they) may be viewed as a progressive actualization (related to the development of the central nervous system) of a certain set of preformations; in the process of actualization a genetic program seems to regulate the organic epigenesis, though the latter still remains in the interaction with the environment and objects. (Piaget, 1979, p. 55)

In the sixth chapter of *Thinking and Speech*, Vygotsky used a counterargument to Piaget's point of view:

[T]here are only two possibilities for explaining the relationship between the development of oral and written speech, between native and foreign languages, between the logic of action and the logic of thought, and between the logic of practical thinking and the logic of verbal thinking. These two possibilities are mutually exclusive. The first type of explanation relies on *the law of displacement*. Here it is assumed that processes of development that have occurred at earlier stages are repeated or reproduced with the development of more advanced functions; the basic difficulties encountered in earlier processes of development are manifested once again at the higher level. . . . The second type of explanation provides the basis for our hypothesis of *the zone of proximal development*. This form of explanation is based on the notion that analogous systems in higher and lower domains develop in contrasting directions. This is the law of interconnections between higher and lower systems in development. (Vygotsky, 1982c, p. 267; E., 1987, p. 222)

According to Vygotsky, his disagreement with Piaget resulted from a different understanding of the relationship between learning and development (cf. Vygotsky, 1987). Piaget did not specify the relationship between the two, and Vygotsky believed that in the process of a child's maturing, a relationship between learning and development was transformed. Initially, development predominantly determines learning, while later, learning determines development. Learning therefore determines new specific types of activity, new functional links, and new operations. "We think that the specific function of each special intercentral system is first of all to provide for a completely new, productive form of conscious activity and not just one that inhibits or stimulates the activity of lower centers. Most important within the specific function of each higher center is the new *modus operandi* of consciousness" (Vygotsky, 1982b, p. 172; E., 1997, p. 142).⁵ That is what we read in his theses on localization.

Returning to Vygotsky's last work, we should note that, while speaking about the principles of future neuropsychology, Vygotsky also offered details regarding the methodological requirements for

psychological experiments, in particular, for the method of clinical-psychological assessment. First, these requirements assume the necessity of analysis carried out on a “per units” basis, and second, they require a systemic analysis. Vygotsky did not separate clinical psychology from theoretical psychology, which explains why at this point we have to address the issue of analysis per units.

Clinical psychological assessment: Analyses “per units,” and disputes around it

At a meeting of the Chair of General Psychology at Moscow State University, M.G. Iaroshevskii pointed out during a discussion of his book on Vygotsky that Vygotsky “searched for a ‘cell’ and did not find it; instrumental psychology had exhausted itself; and an attempt to establish the unity of affect and intellect had failed” (“V poiskakh . . .”, 1994, p. 52). Of course, Vygotsky had depleted the resources of instrumental psychology, but this fact allowed him to build and implement a new program of research. Vygotsky’s understanding of “cell” and “affect” was also not so bad. Let us start with “cells,” which represent the “units which are not further decomposable and which retain in most simple form the properties proper to the whole as a certain unity” (Vygotsky, 1982b, p. 174, E., 1997, p. 143), and they will lead us to the affect.

In [*Thinking and Speech*], Vygotsky identified the meaning of a word as a unit of verbal thinking. In a “live drama of verbal thinking” the meaning of the word changes to one of its senses. Sense, as a unit of the dynamic whole, carries in itself, in a hidden form, the preceding motive, thought phases, and the next phases of the process leading from thought to word. Sense, as a unit of verbal drama, emotionally (i.e., affect-motive) colors both the perception of the interlocutor’s word and the response to it, that is, a meaningful word as a microcosm of human mind is polyphonic (on the proximity of ideas of L.S. Vygotsky and M.M. Bakhtin see Akhutina, 1984a; Hansen-Love, 1978, pp. 426–62).

Thus, sense represents the unity of affect, perception, and action,

all of which, in Vygotsky's opinion, were characteristic of any act of behavior in animal or man. Vygotsky spoke about this in his manuscript "Early Childhood" (1984a; E., 1998) in which he emphasized the holistic unity of perception and action connected through motive, need, or, speaking in broader terms, through affect, and contrasted it to a reflex arc and ring (Vygotsky, 1984a, pp. 292, 294; E., 1998, pp. 223, 225). The components of this triad correspond to three functional blocks of the brain, which were identified by Luria decades later (Luria, 1973, p. 84 and following; E., 1973, pp. 43 and following).

Speaking about the development of the affective sphere, Vygotsky used a psychological (more accurately, neuropsychological) argument:

Affective functions betray an immediate link with more ancient sub-cortical centers . . . as well as with the most recent, specifically human, areas of the brain (frontal lobes), which are the last to develop. Reflected in that fact is the situation that affect is . . . a prologue and epilogue of the entire psychological development. (Vygotsky, 1984a, pp. 296-97; E., 1998, pp. 226-27)

Modern psychological and neuropsychological research has confirmed the constructive character of Vygotsky's idea on the unity of affect and intellect (cf. Khomskaia, 1992; Stuss, 1991; see also an entire issue of the journal *Brain and Cognition*, 1992, vol. 20, no. 1, which is dedicated to the functions of the frontal lobes, in particular, the articles on emotions).

Clinical psychological assessment: Systemic approach

The last point of Vygotsky's "neuropsychological testament" referred to the way systemic analysis should be arranged in clinical-psychological assessment. A more detailed description of this issue was provided in the manuscript [*Diagnostics of Development and the Pedological Clinic for Difficult Children*] (1983; E., 1993) written in 1931. Vygotsky also addressed this issue in an uncompleted book on developmental psychology in the chapter

[The Problem of Age] (1984a, 1998). In this manuscript, Vygotsky distinguished between two kinds of developmental diagnostics: normative developmental diagnostics, and so-called clinical diagnostics. The first one implies identification of an actual level of development and a zone of proximal development. Its goal is to identify the current state of development in relation to both mature and not fully formed, developing processes using the age norms. Unlike the first symptomatic developmental diagnostics, the second diagnostics is based on “determining the internal course of the process of development itself” (Vygotsky, 1984a, p. 267; E., 1998, p. 204). Following A. Gesell, Vygotsky ascertained that equating developmental symptoms with age-related standards gave only initial points for comparative research in children and their diagnosis. In Vygotsky’s understanding, a true diagnosis is not equivalent to an empirical statement of developmental symptoms. “A true diagnosis must provide an explanation, prediction, and scientific basis for a practical prescription” (Vygotsky, 1984a, p. 267; E., 1998, p. 205).

In this connection, Vygotsky (1984a; E., 1998) considered the methods based on the “purely quantitative concept of the child’s development” (Bine and Rossolimo) to be insufficient, insofar as they were limited predominantly by negative characterizations of a child and resolved a “negative problem of identifying unfit children for standard schools” (Vygotsky 1984a, p. 273; E., 1998, p. 210; Vygotsky mentions Binet-Simon, 1905 and Rossolimo, 1910).

In order to provide a positive characterization of a child, and to grasp his/her unique qualities, we need: (1) a specialization of the research methods of particular functions; (2) separation in exploring the factual data and their interpretations, that is, a differentiation between the primary and secondary defects, as well as a psychological interpretation of the observed phenomena and facts; (3) a dynamic and typological interpretation of the data assuming explanation of both positive and negative observed symptoms by the same principle, that is, bringing even distant symptoms “into a unity,” into a consistently built structure.

Vygotsky, a shrewd practitioner and analyst, purposefully clari-

fied the mechanism of interpretation and qualification of symptoms. He wrote that the methodology of research forms a circle: It starts with the discovery of a set of symptoms and proceeds to the identification of the underlying process up to the actual diagnosis; then, from the diagnosis back to the symptoms again, uncovering the mechanism of their formation. It is possible to move to an etiological diagnosis only based on that kind of analysis: “Some authors’ attempts to link the symptomatological picture directly to etiological analysis, bypassing diagnosis, inevitably lead to the disappearance of a central . . . point in pedological research” (Vygotsky, 1983, p. 318; E., 1993, p. 289).

It is obvious that Vygotsky started developing the methodology of neuropsychological research with the most challenging part—children’s diagnostics: diagnosing children is immeasurably more difficult than diagnosing adults, and even today children’s diagnostics is still in the process of development. Applying the opposite approach, Luria started with simpler things. Before considering the way Luria elaborated on Vygotsky’s ideas, we will conduct a comparative analysis of the initial and final phases of Vygotsky’s scientific work.

“The key to understanding the nature of human consciousness”

Finishing his fundamental publication [*Thinking and Speech*], Vygotsky summarized the results of his work:

We have tried to study the word’s relationship to the object, its relationship to reality. We have tried to study the dialectical transition from sensation to thinking and show that reality is reflected in thinking differently than it is reflected in sensation. We have tried to show that the word’s distinguishing feature is a generalized reflection of reality. . . . The consciousness of sensation and thinking are characterized by different modes of reflecting reality. There are different types of consciousness. Therefore, *thinking and speech are the key to understanding the nature of human consciousness.* (Vygotsky, 1982c, p. 361; E., 1987, p. 285)

Thus, in 1934, Vygotsky readdressed the topic of the article he had written nine years earlier. How simple this theme was in 1925, and how voluminous its understanding was in 1934, and how interdependent they still remain!

The meaningful word is the microcosm of human consciousness . . . the relationship between a thought and a word has expressed itself as movement through an entire sequence of inner plans. . . . It would be, however, wrong to believe that only that way from thought to word [motive–thought–inner speech–semantic plan–verbal speech—T.A.] is always manifested in reality. On the contrary, the most diversified . . . direct and reverse movements, direct and reverse transfers from some plans to others are possible. (Vygotsky, 1982c, pp. 358, 361; E., 1987, pp. 282, 285)

What does this understanding of the verbal thinking process mean for neuropsychology? Applying the principles outlined by Vygotsky, his followers might say that verbal thinking is a systemic dynamic formation. The process of its development requires an organization of functional systems involving external social means. Its psychological structure and brain localization both change in ontogenesis and actual genesis as well as interconnections and functions of the brain structures. The followers of Vygotsky are evidently aware of the fact that “the problem of localization ultimately is a problem of the relation between structural and functional units in brain activity” (Vygotsky, 1982b, p. 168; E., 1997, p. 139). They are also aware of the need to conduct the analysis “per units, and not per elements.” At the same time, how can this knowledge be applied taking into account that in verbal thinking everything is connected with everything and everything keeps changing? This was the primary issue that Luria addressed.

Luria as a creator of neuropsychology

Beginning in October 1934, Luria worked in a laboratory of the Institute of Experimental Medicine, and later became a student in

the medical department. In 1937, Luria started his work in the Institute of Neurosurgery. In 1939, he returned to the Institute of Experimental Medicine, and in 1941, he organized an evacuation hospital. Before the war, Luria analyzed the symptoms of sensory and semantic aphasia, as well as the premotor syndrome; however, it was not until 1947 that he presented a completed system in his book *Traumatic Aphasia*.

What Ariadne's Thread did Luria find? His approach could only have been a historical-genetic one. Just like L.S. Vygotsky and N.A. Bernshtein, Luria turned to works on the evolution of the brain, specifically the cerebral cortex. In the cortex one can find the oldest and the most elementary zones—the primary sensory and motor areas over which secondary areas are built. Speech zones develop based on these older zones, and therefore preserve basic, common features by virtue of their genetic proximity. The analysis of common characteristics, typical of any speech zone and bordering areas, allowed Luria to evaluate the specific contribution of these areas to integrated brain activities. “For us the study of marginal [border—T.A.] zone lesions will not be simply an investigation of the symptoms arising from ‘lesions to neighboring areas,’ but rather a methodological step toward unraveling more complex forms of aphasia into their constituent parts” (Luria, 1947, p. 66; E., 1970, p. 103). Thus, Luria found a way to single out the primary defect, as well as a method to qualify symptoms, which was mentioned by Vygotsky.

Luria consistently incorporated many ideas formulated or developed by Vygotsky into his study on aphasia. Vygotsky was the first to use the notion of the phoneme in explaining child and adult disorders of speech comprehension, which was necessary in analyzing the symptoms of sensory aphasia and alalia (i.e., acoustic agnosia in children). This term was used by A.R. Boskis and R.E. Levina in 1934, and by A.R. Luria in 1940. Vygotsky's differentiation between reference [*predmetnaia otnesennost'*] and categorical meaning, described in [*Thinking and Speech*], was used by Luria to explain the mechanisms of difficulties in symptoms of

sensory and semantic aphasia; and the idea of inner speech was used to interpret dynamic aphasia (cf. Akhutina, 1975; E., 1978).

Relying on the principle of system organization of higher psychological functions, Luria used neuropsychological analyses of functional impairments in various cases of local brain damage for identification of the set of components of different higher psychological functions. Thus, Luria's analysis of the impairment of speech and writing ability (cf. Luria, 1950; Luria, 1975) allowed him to identify a set of processes incorporated into these complex functions. A detailed comparison of the results of such analyses with contemporary models of speech generation, on the one hand, and Vygotsky's ideas about verbal thinking processes, on the other, proved the fruitfulness and reliability of Luria's methods of neuropsychological research (cf. Akhutina, 1989).

Together with the principle of the systemic organization of brain functions, Luria vigorously applied the principle of social genesis of the higher psychological functions to the development of methods of the rehabilitation of brain functions. In his 1948 book, Luria, and later L.S. Tsvetkova and other followers, relied on Vygotsky's idea, which is worth quoting again: "Research into the compensatory functions that develop in these disorders also shows that the objectification of a disturbed function, i.e., bringing it outside and changing it into external activity, is one of the basic roads in the compensation of disorders" (Vygotsky, 1982b, p. 174; E., 1997, p. 143).

The principle of the dynamic localization of functions was implemented to the full extent at a later stage of development of neuropsychology (cf. Luria, Simernizkaia, and Tibulevich, 1973; Simernizkaia, 1985). This principle is not yet completely assimilated today, which explains why in some publications researchers still appear to be puzzled over differences in consequences of brain damage of the same zones in adults and children.

The initial interpretation of Luria's neuropsychological research was presented in the book [*Traumatic Aphasia*] (1947/1970), and more completely in [*Higher Cortical Functions*] (1969/1967).

Thus, in agreement with Vygotsky's theory, Luria built a new psychological discipline—neuropsychology. Luria's research pertaining to the brain organization of the mental functions as well as to the role of speech in the formation of voluntary actions has received worldwide recognition, placing him among the most distinguished psychologists of the twentieth century.

Conclusions: Three phases in Vygotsky's research

In conclusion, let us return to the intention stated at the beginning of the article, which was to consider the way Vygotsky progressed in resolving a basic challenge to psychology, namely, the problem of the localization of mental functions.

Our analysis allowed us to identify three ways of addressing the issue. The most general analysis of correlation between the social and biological genesis of the human psyche was typical of the first period. Then, a question of systemic organization and localization of mental functions was representative of the second period. Finally, Vygotsky focused on the problem of the actual genesis of mental functions, and the variety of ways the functions are carried out, that is, dynamic organization and localization of mental functions.

These three ways of addressing the problem of localization form part of the three various research programs developed by Vygotsky. The first program can be labeled by the word "sign," relying on philosophy and biology. The second program can be determined by the word "meaning," which emphasizes the role of linguistics (e.g., language as a system) and neurology (the brain as a system), insofar as "meaning and the system of functions are internally connected" (Vygotsky, 1997, p. 138). The third program can best be understood via the polyphonic and dynamic understanding of "sense." Analogy with the previous statement allows us to claim that the "sense" and dynamics of the system of functions (that create the possibility of a diversity of connections and contexts) are inherently tied together. "The basic principle of the operation of the higher

psychological functions (= personality) is a social interaction (auto-stimulation, ‘entering into the possession of one’s own body’) between functions that replaced interaction between people. They can be accomplished to the full extent in the form of drama” (Vygotsky, 1986, p. 55). It is at this point that Bakhtin, art theoreticians, teachers, and psychiatrists have become Vygotsky’s interlocutors. Vygotsky’s programs maintain different significance for his various followers and disciples, for instance, for A.N. Leontiev—predominantly the first and the third programs; for A.R. Luria—the second and the first programs; and for B.V. Zeigarnik and L.I. Bozhovich—the third program (cf. Zeigarnik, 1981).

In my opinion, L.S. Vygotsky was the “father” of not just one, but several scientific paradigms. However, with his creative work, theoretical schools are not the only important aspects of his life’s work. His ideas have been modified and continue to influence psychological practices today, including pedagogical, clinical, and consultative realms. We are justified in believing that new generations of psychologists will interpret Vygotsky’s research programs in their own ways.⁶

Epilogue to the English translation

Seven years have passed since the publication of this article in Russian. During this time I have had the opportunity to find some new materials. First of all, there was an article in the same issue of *Voprosy psikhologii* (1996, vol. 5) by two students and co-workers of L.I. Bozhovich (she was among the “five” [*piaterka*] well-known young pupils of L.S. Vygotsky—A. Zaporzhets, L. Bozhovich, L. Slavina, R. Levina, and N. Morozova). Two students of L.I. Bozhovich, A.M. Prikhozhan and N.N. Tolstykh, wrote that Bozhovich had distinguished three phases of Vygotsky’s work: (1) The investigation of “new psychological formations appearing during human life and activity on the basis . . . of human experience formed historically” (p. 65); (2) elaboration of the connection between mental development and the formation of new

interfunctional structures—“psychological systems”; (3) elaboration of the problem of the connection between affect and intellect, which is a key issue in understanding a child’s personality development. Such a division is in agreement with the one I have suggested.

Next, I became acquainted with Norris Minick’s (1987) attempt to reveal stages in Vygotsky’s scientific work: 1925–30, instrumental phase; 1930–32, interfunctional phase; and 1932–34, the semiotic phase (pp. 17–34). I agree with his phases in general, but not with some important details. First of all, I cannot agree with Minick’s statement that “conspicuously absent in Vygotsky’s work between 1930 and 1932, however, was any systematic attempt to explain how or why new psychological systems develop” (Minick, 1987, p. 18). From my point of view, the whole book *Thinking and Speech* (except the last chapter that is referred to in the third phase) is devoted to this issue. Vygotsky demonstrated that a word changes thinking, then thinking changes a word, and as a result categorical meaning (i.e., a new psychological system) appears in addition to referential meaning. There are no barriers between the second and the third phases, and the second phase is also semiotic in a certain sense.

And the last and most important point: in A. R. Luria’s archives, I read Vygotsky’s letters to Luria. Many of them are not yet published. The last one (November 21, 1933) sent to Kharkov contains some of Vygotsky’s answers to Luria’s questions. In our context, one answer is the most interesting: Vygotsky answers a question regarding the possibility of publishing a series of articles on the “investigation of higher psychological functions in development and disintegration.” With the permission of Elena Radkovskaia (the owner of the Luria archives in Moscow, and Luria’s grand niece), I will cite from this letter:

(1) At last, about the series [of articles]. If it is going to be really published (from issue to issue without fail), it is necessary to consider [it] with much responsibility. I [Vygotsky] am ready to prepare an article on the classification of aphasia; (2) Birenbaum and Vygotsky. Aphasia and

dementia; (3) Birenbaum and Zeigarnik. Agnosia; (4) Vygotsky—written speech using cases of brain lesions; (5) Vygotsky—grammar *disorders* "ohne Zahl" [here: immeasurable] as our patient answers the question "How many fingers are on a hand?" I [Vygotsky] will have finished one article by mid-December, and we will prepare 3–4 articles to keep in reserve. The title of the series will be general, such as in Goldstein's and Lewin's titles, etc.

P.S.: The title of the series could be:

1. Investigations of higher psychological functions in their development and disintegration.
2. Investigations in clinical psychology.
3. Experimental and clinical studies on psychopathology.
4. Investigations of thinking and speech in pathological disorders.
5. Psychological investigations of nervous and mental disorders.
6. Psychological clinic of nervous and mental disorders.

In the text of the letter there are two persons mentioned: these are Gita Vasilievna Birenbaum and Bluma Vulfovna Zeigarnik, who were colleagues of Vygotsky and former students of K. Lewin. Their well-known [diploma] theses were devoted to the forgetting of the intentions and the recalling of incomplete actions, published in 1926 and 1931, in *Psychologische Forschung* [Psychological Research].

This list of possible, but not completed, articles eloquently reflects the fact that Vygotsky was inwardly ready to develop the theory of neuropsychology and its practical implementation.

Notes

1. Here is the quotation from Marx: "But what distinguishes the worst architect from the best of bees is this, that the architect raises his structure in imagination before he erects it in reality. At the end of every labor process we get a result that already existed in an ideal form, that is, in the imagination of the laborer at its commencement" (K. Marx, *Das Kapital*, Vol. 1, Part 3, p. 193).

2. Much later A.R. Luria, studying the development of voluntary actions in children, demonstrated that control over speech reactions appears earlier than control over motor activity (Luria, 1959). This observation was confirmed by the data on verbal and nonverbal discrimination tasks (Passler, Issac, and Hynd, 1985).

3. I do share the point of view of M.G. Iaroshevskii regarding the need to

distinguish between conceptions typical of various periods of Vygotsky's creative work. However, I cannot agree with Iaroshevskii's statement that the initial period of Vygotsky's work (i.e., prior to 1927) was characterized by a "lack . . . of orientation toward Marxism and the principle of symbol/sign mediation of mental functions" (Iaroshevskii, 1993, p. 54).

4. A handwritten copy of the autobiography (that was probably worked on in 1976–77) was graciously provided by E.A. Luria. It differs from two other published versions in Russian and in English (Luria, 1982; E., 1979).

5. The appearance of specifically human operations (new rules of operating) may be demonstrated during the analysis of the formation and disintegration of syntactical operations; the analysis displays the presence of three syntactic layers, built one upon another (Akhutina, 1989).

6. The author expresses gratitude to G.L. Vygodskaia, A.V. Akhutina, and A.V. Kurganskii for discussions of various aspects of L.S. Vygotsky's creative work. Special thanks are due to Dorothy Robbins for her inspiring interest in my work and for fruitful discussions.

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