Introduction to the English-Language Edition:
Vygotsky-Lurian Approach to Neuropsychology

The goal of our introduction to the Russian-language edition was to acquaint the reader with the contemporary, mostly western interdisciplinary research on child’s development that has provided the context for our studies. The goal of this second introduction is to review the foundations of the Vygotsky-Lurian neuropsychological approach and the interpretation of learning difficulties derived from it. This review will prepare us to answer the main question posed in this book: How has the Vygotsky-Lurian approach contributed to the elaboration of remedial methods for helping children with learning disabilities?

Lev Vygotsky was a founder of cultural-historical psychology. He is commonly associated with general and developmental psychology, educational psychology, special education, and the psychology of art, but his contribution to the development of neuropsychology is not so well known. On the contrary, Alexander Luria’s contribution to this field is widely recognized. According to a survey of neuropsychologists conducted by Charles Long in the 1980s, Luria was named to the top spot among the ten founders of neuropsychology (Puente R, 1998). His influence is strong even today, and the editors of the *Handbook of School Neuropsychology* in the preface called him “the most famous of all neuropsychologists” (D’Amato, Fletcher-Janzen, & Reynolds, 2005, p. ix). Why then do we call the approach that we have developed the Vygotsky-Lurian approach? There are two reasons. First, both scientists created the theoretical foundations of neuropsychology – its main principles – on the basis of cultural-historic concepts suggested by Vygotsky (Luria, 1965, 1980; see also Khomskaya, 1996R; Akhutina, 2003, 2004a, 2004b; Glozman, 2002R). Second, Vygotsky made significant contributions to our understanding of both normal and pathological child psychological development, and consequently, a number of advancements in child neuropsychology are particularly closely connected with his ideas.
Yet it was the joint efforts of both researchers that laid the foundation of neuropsychology. In 1925–6, Lev Vygotsky joined Alexander Luria in the Clinic of Nervous Diseases of Moscow University, which today is a part of the I. M. Sechenov Medical University of Moscow. There Luria headed a small laboratory where he investigated neuroses with the help of the combined motor method. Vygotsky had another – more fundamental – aim: he wanted to discover the foundations for a new natural-scientific psychology that could explain not only elementary but also higher mental functions in normal adults, in pathology, and in child development. He set himself to the task of combining the paradigms of “Naturwissenschaften” and “Geisteswissenschaften,” as he described in 1924: “This new psychology will be a branch of the general biology and at the same time the basis of all sociological sciences. It will be the knot that ties the science of nature and the science of man together” (Vygotsky, 1997a, p. 61).

On October 9, 1930, in the same clinic at a conference of Vygotsky’s research group and medical colleagues, Vygotsky presented the report, “On Psychological Systems,” in which he summarized the results of both genetic and pathological lines of his research as a basis for the idea of systemic structure of higher mental functions (HMFs), the key principle of contemporary neuropsychology; he connected this systemic structural principle with the principle of the social genesis of HMF (Vygotsky, 1997a, pp. 91–107).

In 1931 Vygotsky and Luria resumed their medical studies (Vygotsky had dropped out of medical school in 1913 and Luria in 1923), when they were both accepted to the Kharkov Medical Institute. They studied together for the exams and discussed clinical cases that Vygotsky had seen in Moscow (there are notes in his archive on a number of patients, some of which are presented in Zavershneva, 2010) and Luria had in Kharkov. In his letter (June 26, 1933) written from Kharkov to L. P. Linchina, his future wife, Luria wrote the following:

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 psychosis 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 R, pp. 80–1).

The progress they were making in intensive research in the field of neuropsychology is clear from Vygotsky’s letter, written on November 21, 1933. Replying to Luria’s question concerning the possibility of publishing
a series of articles on the “investigation of higher psychological functions in
their development and disintegration,” Vygotsky answered,

At last, about the series. If they are going to actually publish it and pub-
lish regularly (from issue to issue without fail), it is necessary to take it
with all responsibility. I have [the articles] 1). The classification of apha-
sia; 2). Birenbaum and Vygotsky. Aphasia and dementia; 3). Birenbaum
and Zeigarnik. Agnosia; 4). Vygotsky – written speech in cases of brain
lesions; 5). Vygotsky – grammar disorders – “ohne Zahl” [without num-
ber, numberless] as our patient answers the question “How many fingers
are there on one hand?” – I will submit one article by mid-December,
and we will prepare 3–4 articles to keep in reserve (Vygotsky, 2004 R; this
letter in English was published in Akhutina, 2003).

Vygotsky never wrote the articles he mentioned, although items 2 and 3
were partially completed together with G. V. Birenbaum and B. V. Zeigar-
nik – proponents of Vygotsky’s ideas and former students of Kurt Lewin
(Samukhin, Birenbaum, & Vygotsky, 1934 R; Zeigarnik & Birenbaum, 1935
R). Nevertheless, in many of Vygotsky’s writings and lectures delivered in
1932–4, especially the ones from 1934, he outlined the ideas that formed a
foundation for the science of neuropsychology (see for example, Vygotsky,
incorporated these ideas into the integral theory and practice of neuropsy-
chology.

The science of neuropsychology established by Vygotsky and Luria stud-
ies the functional structure and brain organization of higher mental func-
tions (HMFs). Vgotsky developed the basic concept of neuropsychology –
higher mental functions (also known as higher psychological functions) – and
Luria elaborated on their definition: “the higher human mental functions
are complex self-regulated processes, social in origin, mediated through
structure and conscious and voluntary in their mode of function” (Luria,
1980, p. 30), and they “have a social genesis, a systemic structure, a dynamic
development” (Luria, 1967, p. 55). Vygotsky also revised the basis for distin-
guishing between higher and lower mental functions as he came to embrace
a systemic understanding of higher mental functions: “Higher mental func-
tions are not built up as a second story over elementary processes, but are
new psychological systems that include a complex merging of elementary
functions that will be included in the new system, and themselves begin to
act according to the new laws” (Vygotsky, 1999, p. 43; see also his notes to
himself published in Zavershneva, 2010).
Thus, the three main principles of Vygotsky-Lurian neuropsychology are as follows:

1. social genesis of higher mental functions (HMFs)
2. systemic structure of HMFs
3. dynamic organization and localization of HMFs

**SOCIAL GENESIS OF HIGHER MENTAL FUNCTIONS**

The principle of the social genesis of HMF is well known: “every function in a child's cultural development appears on the stage twice, in two planes, first – social, then – psychological; first between people as an inter-mental category, then within a child as an intra-mental category” (Vygotsky, 1997b, p. 106; cf. translation, Wertsch, 1985, p. 60). The transition from joint social functioning to an individual’s mental function – in other words, the process of internalization – is at the same time, according to Vygotsky, a transition from external to internal: “Every higher mental function was external because it was social before it became an internal, strictly mental function” (Vygotsky, 1997a, p. 105).

Vygotsky describes the stages of internalization using the example of voluntary actions: “First, an inter-psychological stage – I order, you execute. Then an extra-psychological stage – I begin to speak to myself. Then an intra-psychological stage – two points of the brain that are excited from the outside (that are externally stimulated – T. A.) develop a tendency to work as a unified system and eventually form an intracortical point” (1997a, p. 106). The stages of transition from external actions to speech and finally to internal action, identified by Vygotsky, are very similar to the stages of voluntary action development described by P. Y. Galperin (1969). These stages form the main path of developmental or remedial interventions. We follow Vygotsky’s idea that “objectification of a disturbed function, i.e. taking it outside and changing it into an external activity, is one of the basic ways to compensate for the deficiencies” (Vygotsky, 1997a, p. 143). This theoretical platform became the basis for creating the remedial methods presented in this book.

Vygotsky’s ideas on the sociogenesis of HMFs and his diagnosis of the zone of proximal development and learning are more familiar to the western scientific community than his understanding of the principles of systemic and dynamic organization of functions. The first principle is used in both developmental education and rehabilitation and the correction
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(prophylactic) of learning difficulties (Bodrova & Leong, 2007; Braga et al., 2005; Cole, 1985, 1996; Daniels, Cole, & Wertsch, 2007; Kozulin & Gindis, 2007; Kozulin et al., 2003; Ylvisaker & Feeney, 2008).

SYSTEMIC STRUCTURE OF HIGHER MENTAL FUNCTIONS

Vygotsky postulated the principle of the systemic structure of HMFs, but A. R. Luria developed it. In his book, Higher Cortical Functions in Man, Luria wrote, “We are indebted to Vygotsky for his detailed substantiation of the thesis that higher mental functions may exist only as a result of interaction between the highly differentiated brain structures and that each of these structures makes its own specific contribution to the dynamic whole” (Luria, 1980, p. 34). Here is what Vygotsky wrote on this topic in his last work: “It [research] demonstrates…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” (1997a, p. 140).

The understanding of the systemic structure of HMFs made it possible to determine their localization in the brain and thus opened the door to the analysis of their components. A contemporary cognitive neuroscientist has noted that the main contribution of clinical neuropsychology is not the discovery of the brain substratum of mental functions but rather the analysis of their components, which A. R. Luria completed so brilliantly (Luria, 1973, 1980). In Essays on the Psychophysiology of Writing (1950 R), A. R. Luria pioneered the task of describing the structure of a complex functional system of writing using neuropsychological methodology.

Advancements in clinical neuropsychology, including analysis of the components of HMFs, would have been impossible without the new diagnostic approach suggested by Vygotsky and developed by Luria. Based on the systemic character of HMFs, Vygotsky identified the primary impaired component (primary defect1), the secondary systemic consequences of the primary defect, and tertiary compensatory reorganizations as parts of the brain lesion syndrome in adult patients (or of abnormal development in

1 Although the term “deficit” is frequently used in English-language literature, the word “defect” is more appropriate because it implies a disturbed process that is not necessarily a deficit. Deficit often implies that a patient is lacking something, but a defect is not necessarily a lack of something but may be a process that results in a psychological function that is not optimal for a given task.
children). We have used the exact same approach to address learning difficulties. For example, in the very common dysexecutive syndrome of learning disabilities, the primary defect is the underdevelopment of programming and control functions (executive functions). Operations such as orientation within a task, planning, switching to other actions, and inhibitory control are disturbed as parts of this syndrome. All of these symptoms are the examples of the manifestation of a primary defect. The problems with all gnostic and mnemonic processes that require concentration of attention, checking and reviewing perceived information, and active memorization constitute the secondary defects. Furthermore, children with this syndrome can develop compensatory reorganization: both positive adaptive and negative maladaptive. Self-talk, self-commands, and self-discussions of the task (i.e., a transition from the intra-psychological level of a voluntary action to the extra-psychological level) are examples of a positive reorganization. Adopting the role of a class clown (to attract attention, to withdraw from the situation of failure, and to increase self-appraisal) is an example of a negative compensation.

To help children with learning disabilities we use the methods for developing programming and control functions described in this book. As part of their curriculum, Tools of the Mind (Bodrova & Leong, 2007; see also Diamond et al., 2007 – we mention these publications in the first introduction), Elena Bodrova and Debora Leong use very similar methods that also implement Vygotsky’s and Luria’s ideas on the development of self-regulation/executive functions in young children (see also Bodrova, Leong, & Akhutina, 2011).

**Dynamic Organization and Location of Higher Mental Functions**

The principle of dynamic organization and localization of the HMFs suggests a variability of each function’s structure and localization. Vygotsky spoke about this concept in his 1931 publication (p. 133) and in more detail in his last report, written in 1934, *The Problem of Development and Disintegration of Higher Mental Functions* (Vygotsky, 1995 R – unfortunately this report was not included in his collected works). Luria also wrote about this principle (Luria, 1973, 1980; Luria, Simernitskaya, & Tybulevich, 1973 R). The dynamic localization occurs because of (1) modification of the structure of functions through ontogenesis, (2) modification of the functional structure depending on the level of automatization, and (3) the possibility of using
different means to achieve the same result; for example, different strategies of information processing: holistic vs. analytic.

The Vygotsky-Lurian principles of systemic and dynamic organization of functions in their ontogenesis serve as a framework for interpreting varying effects of similar brain lesions, depending on the stage of the development of a given function. This framework has important implications for clinical assessment and intervention and for research into localization of function, because variables such as age at brain insult, type of compensatory processes after insult (Frampton, 2004; Kolb & Fantie, 1997; Nass, 2002; Spreen et al., 1995), time elapsed after insult (Anderson et al., 2001; Simernitskaya, 1985 R), focus of brain lesion (Kolb & Fantie, 1997; Nass, 2002; Simernitskaya, 1985 R), and level of automatization of function (Segalowitz & Hiscock, 2002) need to be considered. Debora Waber describes in detail the modification of the functional structure and localization depending on the level of automatization (Waber, 2010, pp. 105–20). In Russian literature this concept is widely known from the works of Nikolay Bernstein (1967, 1996).

The possibility of using different means to achieve similar results on a given cognitive task has been described in developmental neuropsychology (e.g., Gottlieb, 2001; Temple, 1997), which has emphasized the need to assess the means by which a normal result on a given task has been achieved to uncover hidden deficits or compensatory processes (Johnson & Karmiloff-Smith, 2004; Karmiloff-Smith, 1997). Furthermore, the well-known process approach to neuropsychological assessment in adults emphasizes task analysis and discovery of the means by which a result is achieved to determine lesion localization and to create a profile of impaired and preserved functions (Kaplan, 1988; Milberg et al., 1986; Poreh, 2000; Shear, 2007; White & Rose, 1997).

A good illustration of the Vygotsky-Lurian principles of systemic and dynamic organization of functions is provided by the data on language disorders in children with right- and left-hemisphere lesions. Infants (10–18 months) with right-hemisphere lesions demonstrate more delayed development of both language comprehension and production, whereas toddlers (19–31 months) show more delayed development of word production and near normal comprehension in cases of left temporal lobe lesions (Stiles et al., 1998; Thal et al., 1991; Wulfeck et al., 1991). The finding of the role of right-hemisphere lesions (in light of widely known left-hemisphere dominance for most language functions) confirms the dynamism of the organization and localization of language functions. The interpretation of
the finding in the toddlers is more complicated. Could we conclude that in 2-year-old children language production is supported by brain structures of the left temporal lobe? The answer is no: delayed development of word production is a secondary defect of imperfect phonological perception. The almost normal results in comprehension tasks could be explained by use of a compensatory strategy of relying on different (not phonological but global) features of words, as processed by the intact right hemisphere (cf. Bates et al., 1997; Dick et al., 2005).

The study of the dynamic organization and localization of functions led Vygotsky (1995 R) to a very important conclusion. He compared the consequences of lesions with the same localization in children and adults and found that they differed. Subordinate, underlying operations suffer more in adults, but the defect is compensated by the higher mental functions. In children, by contrast, overlying operations that require the participation of the affected component in their development suffer more. For example, in the cases of underdevelopment of visual perception the acquisition of vocabulary and speech as a whole is affected, which, in turn, causes problems in the development of verbal thinking and, at the same time, delay in the development of visual thinking (i.e., partial defects can cause the significant underdevelopment of several HMFs in children; Vygotsky, 1995 R; cf. Dobbing, 1968, 1975). In contemporary neuroscience the concept of a “developmental cascade” (Karmiloff-Smith, 2002) reflects very similar ideas.

However, in the course of a child’s development, this negative tendency is confronted by the tendency to substitute, go around, and create new “interfunctional connections.” Vygotsky wrote that “the formations which emerge much later and that are less connected with the primary derivative factor are more easy to eliminate with the help of pedagogical influences” (Vygotsky, 1993, pp. 133–4). These tendencies (cascading effect vs. plasticity, with greater plasticity of new formations) constantly compete in the process of a child’s development. The understanding of development as a continuous struggle between various tendencies is very characteristic of Vygotsky and is in accord with contemporary ideas of neurobiology.

According to this understanding, development of a function and of functional systems is a probabilistic self-organizing process. Vygotsky constantly uses the “drama” metaphor when describing it (see, for example, Vygotsky, 1993, pp. 241–91). He joins A. Gesell (1930 R) in characterizing development as “an uninterrupted, self-conditioned process,” in which “the developmental stages in normal and abnormal children flow continuously and organically from one another, as the action does in a well-ordered
drama” (Vygotsky, 1993, p. 253; see also Vygotsky, 1988, p. 147). He states further, “The fundamental methodological issue in pedological research is to discover the internal logic in the drama of child development, to discover the dynamic links among its various crises and events” (1988, p. 253). Vygotsky calls his point of view “causal dynamic” in contrast to “phenotypical.” This approach moves away from the simplistic, mechanical cause-and-effect understanding of the developmental process and its deviations. It is very similar to the modern “constructivist” view of development that includes the ideas of probabilistic epigenesis, relational causality, and the extreme importance of dynamic interplay (= “drama”) of various factors in the process of development (Gottlieb, 1992; Johnson, 1997; Karmiloff-Smith, 2002).

Genes, the organism, and the environment (most importantly, the social environment) constitute the “coactive” developmental factors. Genes bring their biases into the system and thus define not a specific skill, such as reading, but “domain-relevant” functions: those that are genetically connected, for example by belonging to the same type of input (Karmiloff-Smith, 2002). Similarly the condition of certain brain structures brings their biases into a system and defines not a specific skill but domain-relevant functions, such as successful development of motor or auditory functions.

Let us consider this concept in more detail. Vygotsky and Luria, along with the famous Russian physiologist N. A. Bernstein, believed that the history of behavioral organization in phylogenesis is reflected in the structure of the brain: “the brain preserves in itself in a spatial form the documented temporal sequence of development of behavior” (Vygotsky, 1988, p. 123) and that “the development of [the] brain proceeds according to laws of stratification and superstructure of new stories over the old” (Vygotsky, 1997b, p. 102); new structures are built on top of the old while preserving the principal relatedness, the same working style, the “common factor” (Luria, 1970, p. 370, see also pp. 101–3). This is why, when describing the aphasia syndromes, Luria not only wrote about speech itself but also considered related nonverbal deficiencies. This approach is very similar to the modern concept of “embodied cognition,” in which “language (as well as other abstract or higher order skills) emerges from, and is intimately linked to, the more evolutionarily entrenched sensorimotor substrates that allow us to comprehend (auditory/visual) and produce (motor) it” (Dick et al., 2005, p. 238).

Because of their common morphogenesis and close functional connections, certain brain structures are more closely associated with each other, and the disturbance in the functioning of one will, with high probability, cause the dysfunction of the other. These “domain-relevant” connections need
to be considered when analyzing symptom complexes of developmental deviations (this is the approach that A. R. Luria called “factor analysis” or “syndrome analysis”).

To better understand this approach to interpreting syndromes as domain-relevant, let us consider one of the most studied types of learning difficulties in the contemporary body of research on learning disabilities: problems with reading and writing caused by a “phonological deficit.” According to Shaywitz and Shaywitz (2005), “the phonological deficit is domain-specific; that is, it is independent of other non-phonological abilities. In particular, the higher order cognitive and linguistic functions . . . such as general intelligence and reasoning, vocabulary and syntax are generally intact” (p. 1032, emphasis added). We strongly disagree. According to our data, the phonological deficit is domain-relevant, which means that the syndrome usually also involves a decline in short-term auditory-verbal memory, poor vocabulary, and a secondary decline in the variability of syntactic structures; these deficiencies are accompanied by difficulties in perception of nonverbal information, specifically, rhythms that occur with a higher than incidental probability (Akhutina, 2004; Velichenkova, Akhutina, & Inshakova, 2001 R). It is worthwhile to remember that Luria’s tests aimed at the analysis of temporal lobe functions include both verbal and nonverbal rhythm tasks.

Our understanding of the syndrome of a phonological deficit is compatible with the data obtained in psychogenetic research. Several members of the now well-known KE family diagnosed with SLI (severe articulation difficulties accompanied by a grammatical impairment), caused by an allelic variation in the FOXP2 gene, also experienced difficulties in production of rhythmic movements of the hand as well as the perception of rhythm (Karmiloff-Smith, 2005, cf. Konopka et al., 2009). Difficulties in processing of nonlinguistic auditory stimuli (e.g., rapidly occurring tones) were also noted in the study conducted by P. Tallal (1980); however, in contrast to that study, we do not suggest the direct strict causal relationship between difficulties in the processing of nonlinguistic auditory stimuli and the phonological deficit.

Let us return to the topic of “coactive “developmental factors. We have yet to consider the role of the environment in developmental processes. Although they acknowledge the important role of environment, modern “constructivists” do not pay sufficient attention to the differences between the biological and social environment. In contrast, Vygotsky, although he draws a close analogy between the child’s development and the evolution
of species, also emphasizes the differences between the child’s development and the development of animals and human ancestors:

The history of the child cultural development must be considered as analogous to the living process of biological evolution, to how new species of animals developed gradually, how in the process of the struggle for existence, the old species became extinct, how catastrophically adaptation of the living organisms to nature proceeded. . . . Introduced into the history of child development at the same time is the concept of conflict, that is, contradiction or clash between the natural and the historical, the primitive and the cultural, the organic and the social (Vygotsky, 1997b, p. 221).

Explaining this idea of Vygotsky, B. Meshcheryakov writes that “it is exactly in the factor of ideal form that the development of higher mental functions is sharply different from the processes of biological evolution and cultural development through history” (Meshcheryakov, 1998 R, p. 46).

In the course of human life a prolonged period of time is dedicated to the development of vitally important social forms of behavior and learning, and this period has no analogs in the animal world. The child’s development includes the process of internalization of social forms of behavior (thus, we return to the first principle). Vygotsky’s famous statement – “Learning leads development” – emphasizes the role of the social environment; however, although the environment is the main actor, it is not the only character in the “developmental drama.”

It is very important to consider this postulate when creating educational and remedial methods. Unfortunately, many theoretical and practical studies of education and remediation largely ignore the presence of “characters” in the developmental drama other than the social environment. The neuropsychological approach to development and correction of HMFs considers both the biological and social developmental factors.

Following Vygotsky, we consider the developmental syndrome (in normal or abnormal development) a biosocial unity that envelops not only the social situation of development – a form of adult–child interaction that is specific to each age group – but also the state of a child’s HMFs: their weak and strong components, their systemic consequences, and compensatory rearrangements (see also Kirk, 1972; Venger, 1994 R). Consideration of every child’s particular characteristics and the organization of adequate child–adult interactions are required if the remediation process is to be
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successful. How to realize these requirements is the question that our book attempts to answer.

Learning difficulties (LDs) are defined in Russian psychology according to the ICD-10 and DSM-4. The argument that LDs occur as a result of disturbances in cognitive information processing largely due to a biological dysfunction (see ICD-10 F81) typically is elucidated in (Russian) neuropsychological literature as follows: LDs are caused by the partial delay in the development of higher mental functions or, more precisely, the delay of certain components of the HMFs. However the presence of relatively strong and weak structural-functional components of mental functions can be seen in the population as a whole (in adults as well as children) and occurs as a result of interactions between the individual genetic program, individual anatomic and functional organization of brain structures, individual experience, and the subject’s own activity.

We call this phenomenon the uneven development of HMFs in children and adults (Akhutina, 1998a R) and characterize it based on the detailed neuropsychological analysis of the state of HMFs in adults and children (Akhutina, 1998b R; Akhutina et al., 2000 R; Fotekova, 2004 R; Melikyan & Akhutina, 2002 R). The same phenomenon is described in Schretlen et al. (2003). In the course of normal development it is possible to compensate for weak components by implementing various strategies using the strong components of HMF. If the compensation does not occur, the lack of adaptation to social norms is perceived as a deviation in the developmental process, and these students might be diagnosed with learning disabilities. The level of compensation may vary, creating a continuum with high-functioning children with certain individual characteristics on one end, children who have both above and below the norm of abilities in the middle, and children whose strong and weak components are below the norm on the opposite end. The idea of the continuous nature of deviations in development accords well with the dimensional nature of learning disabilities and with psychogenetic research data (DeFries & Alarcon, 1996; Pennington, 2002; Plomin et al., 1994; Plomin & Price, 2001 R).

The uneven development of higher mental functions can be clearly seen in the most widely used assessment measure of mental functioning; namely, the Wechsler intelligence tests. The factor analysis of data on Wechsler tests (WISC-R) has shown three stable factors: (1) language comprehension, (2) perceptual organization, and (3) freedom from distractibility (working memory; Kaufman, Long, & O’Neal, 1986). The presence of the stable factor groups (see Tulsky et al., 2003) shows that in the general population strong and weak mental processes are not distributed in a mosaic pattern,
and it confirms the presence of stable groups of symptoms. Most likely, left posterior zone functions support the functions of language comprehension, right-hemisphere functions support perceptual organization, and left frontal functions support working memory. Thus, the factor structure revealed by the WISC-R could be interpreted as the evidence of relative independence of left posterior zone functions, right-hemisphere functions, and left frontal functions. We became aware of this data only at the end of the 1990s after we had completed our initial studies in the neuropsychology of the norm that showed that normal subjects (both adults and children) can be divided into three groups depending on the presence of relative weaknesses in various components of their HMFs (Akhutina, 1998b; Yablokova, 1998). We were very pleasantly surprised to find out that our division based on neuropsychological characteristics coincided with the one derived from the factor structure of Wechsler’s test data. It was all the more surprising considering that we had used very different methods. We later found out that a fourth stable factor—speed of information processing—was identified by combining Wechsler Adult Intelligence Scale, Third Edition (WAIS-III), and Wechsler Memory Scale, Third Edition (WMS-III), data (Tulsky et al., 2003); this factor could be correlated with the state of the Lurian Unit I functions. Further studies of learning difficulties conducted with T. V. Akhutina as the advisor (Akhutina et al., 2000; Fotekova, 2004; Melikyan & Akhutina, 2002) yielded the same results, which was to be expected considering the continuous character of the transition from the norm to learning disabilities.

Thus, neuropsychological methods can distinguish three main types of learning disabilities:

1. Difficulties in developing academic skills in children with predominant weakness in *programming and control of actions and serial organization* of movements: because of difficulties switching between tasks and the small volume of programming (working memory), these children experience problems with problem solving, and counting, reading, writing, discourse (the so-called compositional skills) (Akhutina, 2004; Akhutina, Obukhova, & Obukhova, 2001; Akhutina, Pylaeva, & Kamardina, in press; Khotyleva et al., 2006; Polonskaya, 2002).

2. Difficulties in developing academic skills in children with predominant weakness in the analytical (left-hemispheric) strategy of *processing auditory and kinesthetic information* (and in some cases also visual information): their primary defect is in phonological processing in
writing and reading and in the tasks of vocabulary and short-term verbal memory.

3. Difficulties in developing academic skills in children with weakness in the holistic (right-hemispheric) strategy of processing visual, visual-spatial, and auditory information: children with an extensive vocabulary and syntax suffer difficulties in the semantic-pragmatic aspect of verbal functions, in writing (surface/spatial dysgraphia), in counting, and in math problem solving.

All three types of difficulties in developing learning skills may be combined with the difficulty in maintaining an optimal level of cortical tone while performing school tasks. These children may have ADHD or attention deficit disorder (ADD) with hypoactivation (underaroused state), thus having a sluggish cognitive tempo (see, for example, Morris et al., 1998; Waber et al., 2000; Weiler et al., 2002). It is important to keep in mind that the weakness of any component in the functional systems of academic skills delays the process of their automatization, which is why performing school tasks remains effortful and energy demanding. When performance of the function overexerts the processing resources, the whole functional system is overloaded and loses (or does not acquire) the necessary selectivity (see the interaction of Units I and III [Luria, 1973, 1980; cf. “the automatization hypothesis in developmental context”; Waber, 2010, pp. 110–20; Waber et al., 2000]).

These three types of learning difficulties are widely known: the most extensively researched type is the second type involving phonological processing; the third type of learning difficulties, which are caused by weakness in right-hemisphere functions, is very similar to the “syndrome of nonverbal learning disabilities” described by Byron Rourke (Rourke & Finlayson, 1978; Rourke, 1995), to surface and constructional (spatial) dysgraphia (Chittooran & Tait, 2005), and to dysexecutive syndrome, although not typically mentioned in the literature on learning difficulties, is often found in publications on ADHD and recently was described by Adele Diamond as one of the variants of ADD as opposed to ADHD (Diamond, 2005).

However, the methods used to distinguish syndromes and the understanding of their mechanisms based on the neuropsychological principles of Vygotsky-Luria differ from the predominant understanding. Even in cases where psychologists share the systemic and dynamic understanding of neuropsychology, they usually do not carry out the analysis of the components of complex functional systems of academic skills and do not differentiate
primary and secondary symptoms in their syndrome analysis of learning disabilities.

For example, each of the types of learning difficulties described earlier includes writing problems, but each type carries with it specific problems. Therefore only a neuropsychological analysis that identifies primary and secondary defects and compensatory reorganization would be able to diagnose the syndrome and understand its mechanisms. Neuropsychological testing of the child’s HMFs is the first step, but it does not permit the full assessment of the possible compensatory changes in the functional systems underlying academic skills. Thus the second step – analysis of the manifestations of learning difficulties – becomes necessary. The methods of neuropsychological analysis of students’ behavior in school and of the mistakes they make in their school assignments (the so-called methods of tracking diagnostics, which we created) supplement the data obtained through testing and qualitative estimations of learning difficulties (Akutina, 2004; Pylaeva, 1995 R). The specific strategy and tactics of remedial education are then created based on these data. For more detailed discussion of different types of learning difficulties and their connections to other characteristics of HMFs, see Chapters 3 and 18. Methods of working with students from different groups are described in Parts II–IV.

**CONCLUSION**

Vygotsky-Lurian neuropsychology is dynamic and systemic. Its opposite, “static neuropsychology” (the term of M. Johnson, 1997) is losing popularity, as evident from a large number of studies of learning difficulties (Berninger, 2004, Berninger & Winn, 2006; Fisher, Bernstein, & Immordino-Yang, 2007; Grigorenko, 2008; Pennington, 1999, 2006; Waber, 2010) and in publications on motor control and developmental motor disorders that are highly influenced by the ideas of N. A. Bernstein (Dewey & Tupper, 2004; Thelen, 1995, 2000, 2002).

If similar ideas can be found in contemporary publications, why then do we turn to the ideas of Vygotsky and Luria? First, their works embody a single integral approach to understanding the development, functioning, and disintegration of mental functions in children and adults. The systemic structure of HMFs is necessarily derived from the principle of the social origin of mental functions, whereas functional systems develop (and change) in the course of child development based on interactions between biological factors and social environment, which brings us back to the principle of the social genesis of HMFs. Modern ideas, many of which have been mentioned
here, are not so unified as a rule and often require alignment with a more holistic framework. Second, Vygotsky and Luria’s texts on the development and disintegration of higher mental functions and on normal and deviant development delve into the essence of these processes; the richness of details helps modern researchers better understand the newly discovered facts and create new methods to effectively help children with developmental and learning disabilities.