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THE HISTORY OF DEVELOPMENTAL NEUROPSYCHOLOGY

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SUMMARY

This paper deals with the theory of the social genesis of higher mental functions (HMF) developed by Vygotsky and Luria. Their systemic cultural-historical approach, the first premise of developmental neuropsychology, stresses the influence of social and cultural factors on the child's cognitive development, the social nature of function formation, and the role of mediation (the use of social means) in the genesis of HMF. The dynamic ontogenic localization of HMF at various levels is discussed, along with the types of brain structures and their functional integration. The psychogenetic studies done in Russia in the 1920s and 1930s by Luria et al., using the twins method, analyzed genotype - environment relations through cultural-historical theory. These studies revealed changes in the relative impact of heredity and environment due to modifications in mental functioning in response to different educative procedures and the role of speech acquisition in mental development. These psychogenetic studies proved that speech and language have a formative effect on mental processes, and that twins form a risk group in terms of mental development. The psychogenetic studies by Luria also formed the basis of neuropsychological remediation, especially the principles of developing games for small children. The differences between the Russian and Western approaches in developmental neuropsychology are discussed, as well as trends in the progress of developmental neuropsychology. This progress is due to the tendency to analyze the dynamics of brain / mind functioning and interaction through the social conditions of a person's life

Key words: social genesis of higher mental functions, functional brain organization, differential neuropsychology, neuropsychological tests

INTRODUCTION

The theoretical basis of developmental neuropsychology as well as of general neuropsychology comprises three principles, proposed by L.S. Vygotsky and A.R. Luria:

- the principle of the social genesis of higher mental functions (HMF);
- the principle of the systemic organization of HMF;
- the principle of the dynamic organization and localization of HMF.

These principles derive from the cultural-historical approach to the analysis of the development of HMF and of abnormalities in HMF, that is, orientation not so much to the disease or the defect as to development, looking at the history of culture for the reasons behind mental phenomena and for the means of their remediation. L.S. Vygotsky proved that a defect interferes with the child's appropriation of the culture, but cultural means help the child to overcome the defect. Hence the cultural-historical approach became and remains a methodological basis for remedial education.

The creation by Vygotsky and Luria of the systemic cultural-historical approach in the 1920s and 1930s should be considered the first step towards the emergence of developmental neuropsychology. One of the first studies based upon this approach was a comparative exploration of mental functions in urban, rural and homeless children. The study demonstrated the influence of social and cultural factors on the child's cognitive development (Luria, 1928, 1930).

In all his works, Vygotsky stressed the social nature of function formation and the role of mediation (the use of psychological tools, i.e. social means) in the genesis of HMF (Vygotsky's principle of "doubling experience").

To understand the theory of the systemic structure of HMF in humans the following factors are the most important:

- the variability of interfunctional relations and connections;
- the formation of complex dynamic systems, integrating many elementary functions;
- the generalized reflection of the environment by conscience;
- mediated mental functioning.

Luria's principle of the dynamic ontogenic localization of HMF refers to various levels and types of brain structures and their functional integration, while acknowledging the same cognitive activity by children of different ages.

Any analysis of Russian developmental neuropsychology cannot omit the psychogenetic studies performed in the 1920s at the Eugenics Office of the Academy of Sciences in St Petersburg, created in 1921, and in the Laboratory of Heredity and Human Constitution at the Moscow Medico-Biological Institute, created in 1928. The former used the genealogical method, while the latter used the twins method, which later proved to be more informative (Ravich-Sherbo & Sygal, 2003), and compared the impact of genetic and environmental factors on the individual variability of the psychological and neurophysiological features of children.

Luria started his work at the Medico-Biological Institute in 1932, the same year in which a paper was published by M.S. Lebedinsky, entitled "The problem of heredity in psychology and the twins method." This paper analyzed the method and the results of the assessment of different mental features (reasoning, mediation capability, temperament) in twins at different ages. It revealed greater genetic similarity of most features in monozygotic twins, as compared to dizygotic, and also the dependence of similarity on the age of the twins and the function assessed. From 1932 till 1937 (when the Medico-Biological Institute was closed and the study of genetics was prohibited), Luria directed studies of genotype-environment relations through cultural-historical theory (Fig. 1). The group included M.S. Lebedinsky, A.N. Mironova, N.G. Morozova and F.Y. Yudovich. They were the first in Russia to use the "twins model" in experimental studies of the genetic mechanisms of mentality. The difference from similar studies in Western countries consisted in the use of special tests addressed predominantly to "natural" (genetic) or cultural (environmental) factors, instead of using standardized batteries measuring IQ. For instance, in nonverbal tasks, which better reveal "natural" factors, the results were more similar in monozygotic twins than in dizygotic ones.

The program for the study of genotype/environment relations, based on the Vygotsky-Luria theory of mental development, revealed changes in the relative contribution of heredity and environment, due to modifications in mental functioning in response to different educative procedures, and to the role of speech acquisition in mental development (Lebedinsky, 1932; Mironova & Kolbanovsky, 1934; Luria, 1936, 1948, 1963, 2002; Ravich-Sherbo & Sygal, 2003). A study of 130 pairs of twins ranging from 6 to 11 years old revealed, for instance, that elementary memory is determined by genotype in all age groups, while mediated



Fig. 1. Some of the twins that participated in the research work of the psychological laboratory of the Medico-Biological Institute (from Luria's archive)

remembering using pictograms was dependent on genotype only in preschoolers. To generalize, the influence of “natural” factors on child cognitive functions decreases with age, while the influence of “cultural” factors increases. “This evidence indicates that during ontogenic development there is dramatic change not only in the psychological structure of mental processes, but also in their internal nature” (Luria, Symernitskaya & Tybulevich, 1973, p. 112).

The research work in the Medico-Biological Institute permitted Luria to state the main ideas of developmental neuropsychology: “mental development in childhood is first of all a modification in the child’s forms of activity, complication of the structure of this activity and enrichment of the mental processes developing inside this activity” (Luria, 1948, p. 34). In the process of development a mental function “does not stay the same; ... it changes significantly its own structure, it solves the same task using different operations” (Luria, 2002, p. 17). Moreover, „the genotype influences to a great degree the speed of appropriation of these ‘cultural’ forms of mental activity...” (Ibid., p. 18).

The psychogenetic studies first pointed to the formative effect of speech and language on mental processes, and then revealed that twins form a “risk group” in terms of mental development. For instance, Luria and Yudovich assessed a pair of 5 years old twins with a lower than normal level of speech and general mental development. The authors supposed that the cause was that the “twin situation” did not stimulate verbal activity, replacing it with more primitive forms of communication. The researchers then placed each twin in a different group of the kindergarten, so that an objective need was created to acquire speech as a means of communication (Luria & Yudovich, 1959). Also, special lessons to develop speech were given to one of the pair. In 3 months, the verbal abilities of these two children (both vocabulary and grammar) changed significantly, and their general mental development improved, to a greater degree in the child who had speech therapy. Therefore, when an objective need for verbal communication was created, not only did both children acquire new verbal means for communication, but significant modifications were provoked in the structure of their conscious activity, based on speech and language.

The psychogenetic studies by Luria also formed the basis of neuropsychological remediation, namely the principles for developing games with small children. In a pair of monozygotic (genetically similar) 6-year-old twins, one was tasked with a construction activity with cubes using a “step by step method” (i.e. copying of teacher’s actions), while the second twin was given the “model” method, where he saw only the general shape of the construction and had to select the elements fitting this shape himself. The second version of the game, aimed at developing visual reasoning and constructive analysis and synthesis abilities, was much more efficient, and the resulting development included some other forms of creative activity and was stable, being evident 18 months after the end of the program (Luria, 1948).

In Western countries, developmental (also called pediatric) neuropsychology became a major area of research and practice during the second half of the 20th

century. “It was in the 1960s that the clinical picture of the ‘clumsy child’ (renamed *developmental dysgnosia* and *dyspraxia*) was described, specific reading disability (renamed *developmental dyslexia*) was investigated from a neuropsychological standpoint, and the concept of *minimal brain dysfunction* (MBD) was formulated to account for these and a myriad of other behavioral disabilities in children. Since that time pediatric neuropsychology has become a flourishing area of inquiry and practice, generating new knowledge and deeper understanding, with the result that today the evaluation and management of children with documented or suspected brain dysfunction by well-informed neuropsychologists are incomparably more insightful and effective than was the case 20 years ago” (Benton, 2000, p. XV).

To conclude, I would like to emphasize that the origin of developmental neuropsychology, as well as the whole development of Russian psychology beginning with Luria’s school, is due primarily to the main achievement in the history of psychology: the creation of cultural-historical psychology, which has greatly influenced clinical neuropsychology all over the world.

TRENDS IN THE PROGRESS OF DEVELOPMENTAL NEUROPSYCHOLOGY

The progress of developmental neuropsychology follows a general tendency all over the world to replace “static neuropsychology” (relating the subject’s behavior, whether adult or child, to defined brain areas) with “dynamic neuropsychology” (analyzing the dynamics of brain/mind functioning and interaction through the social conditions of the person’s life, that is, viewing childhood disorders within a developmental context (Rourke, 1982, 2000; Tupper, Cicerone, 1991; Glozman, 2002, 2010). Such an approach runs contrary to the “biologizing” tendencies of the psychology of the 19th and 20th centuries, and is of value, given that “a division of ‘natural sciences’ and ‘mental sciences’ into different scientific paradigms risks bisecting psychology into two different ones, lacking a common subject and methods of research” (Akhutina, 2004, p. 20). This is very close to the definition of „real psychology” by Luria. In his first book, written in 1922, Luria set himself the task of “studying the human person as a biological, social and psychological unity” (Luria, 2003, p. 296). Analogously, Lev Vygotsky (1925) represented the psychology of the future as the study of “a biosocial synthesis” – a union of natural and human sciences.

It is not surprising that the main causes of delayed development (immaturity) of a child’s functional mental systems is, according to Korsakova et al. (2001), an unfavorable environment during this child’s formative years (complicated intrafamily relations, bad conditions of everyday living, harmful ecological factors, lack of socialization or participation in educative and upbringing programmes).

This explains the predominant importance of *functional diagnostics* (as distinct from the *topical diagnostics* of immature or impaired brain structures) of defects preventing the child from acquiring knowledge and abilities, adapting to society

(school or family), and developing to a greater degree his own potential and personality.

The current period of progress in neuropsychology (both of adults and of children) is characterized by extensive development all over the world. The neuropsychologist is assessing now not only patients with organic focal brain lesions, but also patients with endogenous, genetic and functional disturbances, with individual variations of normal mental functioning, consequences of specific social situations of development (such as social deprivation or bilingualism) and others. This increased range in the types of persons referred for neuropsychological assessment is explained first by the fact that specialists in different branches of psychology have realized the possibilities of Lurian neuropsychological assessment for the differential and functional diagnostics of a great number of abnormal or atypical developmental conditions. Secondly, modern methods of neuroimaging reveal organic cerebral pathology in patients with endogenous and functional disorders, such as stuttering, schizophrenia, or autism. Thirdly, the sphere of neurocognitive disorders increases in conjunction with our understanding of systemic disturbances, including specific primary, secondary and tertiary symptoms (due to functional reorganization during adaptation to disease or resulting from a particular social situation of development. The fourth reason is the common understanding of the role of dysontogenesis for neurocognitive disorders, resulting in greater significance for the neuropsychological assessment of different kinds of abnormal or atypical development.

Another feature of contemporary progress in developmental neuropsychology (as well as other branches of neuropsychology) is a tendency to “enlarge the sphere of application of neuropsychology outside the clinical, pathological cases of disturbances in human mental activity to the study of the mentality of healthy subjects. First of all, it regards cases of deviations (for different reasons) in mental and cerebral functioning interfering with the person’s adjustment in various living situations” (Korsakova et al., 2001, p. 7).

The task in the progress of developmental neuropsychology consists in the need to pass from a phenomenological description of abnormal child development to the study of the interactions between brain, genetics, sociology and personality in the formation of different kinds of abnormal or atypical development. In other words, developmental neuropsychology should now be based on an integrative multidisciplinary approach, founded by E. Lenneberg (1967).

Due to these tendencies in the progress of developmental neuropsychology, it becomes a base for the creation of a service of applied psychology for education (Asmolov, 1998).

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