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Situational Binding and Inner Speech: Cross-Sectional Evidences

Ilya V. Ponomariov

Abstract

Different evidences of inner speech development are gathered and discussed from the perspective of situational binding – a conception developed within the framework of cultural and historical tradition of L. S. Vygotsky. This conception explains and systematizes many facts which have otherwise caused much perplexity to scientific knowledge. It predicts that the future neurobiological research of inner speech in non-school societies should discover that it has fragmentary and sympractical character.

Keywords: *inner speech, developmental science, sympractical culture, linguogenesis, Vygotsky.*

1. Development of Inner Speech

The foundations for development of inner speech are laid from the birth of a child. His/her first words cannot appear from nowhere and the long period of their adoption is necessary. Those children raised by animals (feral children) or deaf-blind ones do not develop speech themselves and if the first sensitive period for language acquisition is over, they have almost an insurmountable impediment to adopt it from other humans (see Meshcheryakov 1979). Let us consider the forerunners of inner speech to find its role in the human development.

Inner speech has the latent, overt and covert periods of development. From the moment when a baby hears the first words, the latent period of speech development is open. That period is characterized with the child being gradually more and more involved in a verbal milieu. Up to one year the averaged child cannot pronounce words, still s/he communicates with adults by means of crying and other sounds. With time infant sounds become more emotionally differentiated, approaching in that respect the speech. Being not able to speak, the child already learns verbal phonemes and semantic structures from adult's developed speech (Vygotsky 1984a).[1]

[1] For references of partial English translations of Vygotsky's works published in Russian and referred here, see Mahn 2003. For the critique of English translations quality see Veer and Yasnitsky 2011.

The overt period of inner speech development begins approximately from the age of one year when a first infant word appears on the background of an unarticulated flow of sounds that s/he actively produces. From this time, the overt speech is beginning to execute more functions in psychic development; but it is evident that embryonic inner speech processes also take place as it was during infancy. Hence, we can speak about the inner speech development from the birth. During the second year of life, the more adult-like speech appears. From three years of age, the overt stage of inner speech development is characterized with the differentiation of private speech from social speech (Vygotsky 1984a, 2001). The former is usually defined as a speech directed more to oneself than to others (see Berk and Landau 1993).

The history of private speech internalization, *i.e.* turning of it into inner thoughts, evidences that it plays a central role for planning and directing child's behaviour (*e.g.*, Fernyhough 2008). Approximately about three years of age this type of speech is yet weak and rather accompanies child's activities than directs them. The situation changes gradually to the age of five when private speech becomes more complex and more involved in self-control. If in three- and four-year-old children one can observe long phrases of private speech, which help them in their activities but often directed to both an interlocutor (often an imagined one) and oneself, towards six years of age the phrases of such type are compressed to one-two words (Vygotsky 1984c). It is very important to notice that the child can now express a meaning of long sentences to oneself with one or two words, because this meaning is clear to him from the context of his past and present verbal experience (Vygotsky 1934), which can also be called a semantic field of speech (Luria 1981; Luria and Vinogradova 1959). The shortening and compacting of private speech is proportionally counterbalanced with the development of partially and fully internalized covert speech operations. The dynamics of speech internalization found in experiments shows how the private speech turns into the inner speech passing the stage of covert one. In this process the private speech loses the verbal structures specific for overt, interpersonal speech, but preserves the sense, planning and directing functions (Winsler *et al.* 2003; Martinez *et al.* 2011).

The crucial role of speech for the development of all major psychic processes can be found in children with atypical development (ADHD, autistic, *etc.*) (Winsler *et al.* 2007a; Akbar *et al.* 2013). These children usually have some deviations in the development of private speech that correlate with some impairment in the genesis of self-control, social competence, emotional regulation, abilities to learn, *etc.* If these children have the private speech of normal estimates, there can still be found some additional, usually organic, factors (mental retardation, memory dysfunction, *etc.*) preventing them from using their speech functions properly (Winsler *et al*. 2007b; Kopecky *et al*. 2005).

The covert speech, which is almost the inner speech, begins to predominate from the age of seven years and marked with the developmental crisis (Vygotsky 1984a, 2001). If some manifestations of private speech are investigated in the age periods between seven and thirteen years, they prove only that this type of speech has been replaced by inner speech operations and that it can only be initiated under conditions of increasing demands on performance (Lidstone *et al.* 2011; Ostad and Sorensen 2007; Lidstone *et al.* 2010). In this age period the learning of literacy (and science) is especially essential for the quantitative and qualitative changes of inner speech to occur (Vygotsky 1934, 2001). Hence, it can be suggested that the potential for inner speech development is initially constrained by the available means and social background. But after thirteen years of age the sensitive period for literacy learning is mostly over which means that many opportunities for the development of inner speech in future are lost (Tulviste 1991).

2. Situational Binding

After the path of inner speech in ontogenesis has been briefly considered, its connections with situational binding can now be analyzed.[2]

Developing consciousness from the birth to the crisis of one year old can be characterized as a sensorimotor unity (Vygotsky 1984a). This unity means that perceptions and actions of a child are united in such a system that any visual stimulus initiates an immediate reaction. This reaction is mediated but only with the system of instinct consciousness, which allows reaction to be very fast and adequate. Thus, the situational binding of this age period can be described as a binding with a visual field (Vygotsky 1984a; Bozhovich 2006). When speech is not yet fully adopted by child, in some cases adult's words are already disturbing the sensorimotor unity splitting infant perceptions from actions. The arising speech further dissociates the sensorimotor unity helping to overcome the situational binding with a visual field. Speech creates a psychic space/field between perceptions and actions which Vygotsky called 'functional barrier' (Vygotsky 1984c). This barrier is a path from animals' instinct movements to human planned actions. The Pavlovian unconditioned reflex evolves into a tool-mediated action and a word is a tool that reorganizes all natural processes of instinct life (Vygotsky 1984a, 1984c).

Central aspect of the overcoming of situational binding after the age of three years is the development of time perspective. As Vygotsky noted, 'No one have ever met a child under three-year-old age who would like to do something over several days' span' (Vygotsky 1966: 63). But in four- and five-year-old children such intentions become gradually more obvious. Speech raises a child above actual affective situations by creating a semantic field in his/her

[2] For the origin of this conception in Vygotsky's works see Ponomariov 2013.

consciousness beside a visual field (Vygotsky 1984c). The perception of actual situation, memories relevant to this situation, and possible consequences of child's actions in future can be combined in a conscious experience only in the semantic field of speech. *Thus, speech creates the inner space and time of consciousness, or the semantic field.* This inner space-time continuum has a potential to differentiate a child's consciousness from the external space and time. Once it has appeared, the situational binding shifts more and more from the binding with a visual field towards the binding with speech operations.

The latest fMRI studies confirm the close connection between speech and memory processes from the perspective of their localization in the brain regions (Marvel and Desmond 2012); this connection also finds wide support in psychometric investigations (Al-Namlah *et al.* 2012; Akbar *et al.* 2013). The semantic field, being a part of organic speech process, has a physiological correlate – 'neural clusters' (Tononi and Edelman 1998), or may be better to say *the localized branches of neurons*. These bunches of neurons develop with age and exercise, each for carrying some specific psycho-physiological operation like reading or imagining a specific event, but they can also substitute each other to some extent. For all the described processes of situational binding, affect is not a determinate but one of the elements in the developing consciousness (Vygotsky 2004, 1934: 191). Some experiments demonstrate the role of private speech in children's emotion regulation (Day and Smith 2013; Winsler *et al.* 2003).

Vygotsky (1984a, 2001) related the emergence of inner speech to the seven-year-old crisis and explained the symptoms of this crisis from that perspective. Studying his works and other scientific data compels us to consider the development of inner speech, or its forerunners from the birth. As we have here tried to show his works and other scientific data compel us to regard the development of inner speech, or its forerunners, from the birth. One of the most specific results of his experimental explorations is the conclusion that from seven to thirteen years of age the central line of psychic development is the growth of 'scientific concepts', or the systems of operations with scientific word meanings (Vygotsky 1934, 2004). It should be noticed that the researcher used the terms 'concept' and 'word meaning' synonymously, as he underlined himself (Vygotsky 1935b: 133; 1934: 114, 131). The operations with word meanings which are developing in the semantic field of inner speech are not purely linguistic or logical (Luria and Vinogradova 1959). They are a part of organic inner speech process with its functions for planning and directing behaviour. They can become purely linguistic or logical only when they are torn from the brain by means of written speech. The development of operations with 'scientific concepts' is slow and painful; it spurs due to schooling as opposed to the genesis of 'everyday concepts' developed by child in his preschool experience (see for other experimental confirmations: Tulviste 1991, 1985). Step by step this process leads to the crisis of the age of 13 years.

Self-esteem and self-examination were already the symptoms of seven-year-old crisis but only the development of inner speech, driven by learning of literacy and science, can bring self-awareness, or reflexion, to a new level. The reflexion develops first in the domain of scientific word meanings, being their immanent feature, and gradually becomes a part of inner speech operations. The reflexion is initially transferred to the functions of consciousness, which are most developed to the age of seven: perception, action, memory, and, to a less extent, will and emotion. According to Vygotsky (2001), thinking (cognition) can become a leading function, which organizes other functions of consciousness in a system, only after perception and memory played that role, the former from the one-year-old crisis to three-year-old crisis and the latter from three to seven years of age. After the crisis of seven years old, thinking becomes a leading function, organizing other functions in a system, but it is not yet developed enough to become a self-aware process itself. Still, thinking can stepwise bring reflexion to other psychic processes, especially if it is subject to schooling. The essence of thirteen-year-old crisis will be that the reflexion of thinking will appear in the inner speech (*Ibid.*). Thus, the system of consciousness becomes with time based more and more on the systems of operations with word meanings in the semantic field of inner speech.

The great paradox of the age development is that after the thirteen-year-old crisis the operations of inner speech, which liberated consciousness from impulsive sensorimotor behaviour and reorganized all its processes, become a central factor of binding. The systems of operations with word meanings in the semantic field of inner speech can now determine the course of individual life more than genetic factors and, to some extent, more than social surrounding (Luria and Yudovich 1956). The 'situational binding' of consciousness with 'scientific concepts' (Vygotsky 1935b: 107) is a characteristic feature of all post-school societies. The semantic binding with word meanings and terms, not less determined with affect than with verbal logic, can be found in most scientific texts, especially in humanities. Many scientists believe in the semantic constructions that they actively create in their minds – in the semantic field of inner speech. They have belief in them because *it is an affective state that characterizes any speech operation of consciousness*. These speech operations, initially maintained to drive behaviour in some direction, can themselves become a single factor dominating the individual consciousness. The semantic binding with these operations greatly precludes further psychic development and it cannot be overcome by means of scientific studies.

In the last months of his life Vygotsky tried experimentally to investigate the systems of operations with word meanings in the semantic field of inner speech, which he called the 'dynamic sense systems', on the samples of both adult patients with frontal dementia and mentally retarded children (Samukhin *et al.* 1934; Vygotsky 1935a; Ponomariov 2012). The centrality of inner

speech systems for all psychic processes was also explored by him in the studies of schizophrenia (Vygotsky 1956, 1981; 1984b: 188–189), which finds some support in the current neurobiology.

John H. Gruzelier's (2003) researches of brain hemispheric asymmetry in schizophrenia and schizotypy allow formulating two types of inner speech dysfunctions. The overproduction of inner speech correlates with the brain hemisphere balance shifting to the left (speech-located for right-handed) hemisphere and such symptoms as behavioural over-activity; manic, grandiose and paranoid ideas; exaggerated or inappropriate labile affect and affective delusions. These symptoms were called by Gruzelier an 'activated syndrome'. The underproduction of inner speech correlates with the brain hemisphere balance shifting to the right, non-speech hemisphere and such symptoms as social and emotional withdrawal, blunted affect, and motor retardation. These symptoms are united by Gruzelier under the title of a 'withdrawn syndrome'. Both syndromes are in agreement with the wide scope of schizophrenia studies (*e.g.*, Liddle 1987; Gordon *et al.* 2001; Gruzelier 2002). The recent fMRI studies also evidence that the hyperintensity of functional networks connected with speech-selective cortical regions is related to such symptoms as hallucinations and Schneiderian delusions in schizophrenia (Rapin *et al.* 2012).

3. Sympractical Culture

The conception of situational binding has already found application in social sciences. The pioneering works belong to Indologist Vladimir N. Romanov (2003) who analyzed many facts gathered from anthropological, linguistic, psychological and cross-cultural studies using this conception.

Rethinking the ideas of Vygotsky, A. R. Luria and P. Tulviste, the psychologists of the cultural-historical school, Romanov managed to explain some practices and social activities preserved in the descriptions of ancient texts. Referring to Luria's distinction between two types of psychological activity (visuopractical *versus* theoretical, the latter being based on scientific concepts), he writes, 'Starting from this distinction, whose accuracy had been proved both through the ontogenetic analysis of abstract conceptual thinking and the ethnopsychological studies of "traditional" societies, psychologists suggested the hypothesis (Tulviste 1977, 1978) that historical roots of abstract conceptual thinking (characterized by awareness not only of relations among the subjects of those concepts, but of relations among the concepts themselves) should have connection with the emergence of new types of "theoretical" social activity in Ancient time' (Romanov 2003: 64).

It is obvious that only the historian and linguist prepared to work with ancient languages can excavate such forms of 'theoretical' social activity, moulded in written sources. Romanov worked with those coined in Sanskrit. Using the example of Ancient India, he showed that such theoretical social activity

can initially emerge in a non-school society via creating a theoretical type of learning on the basis of the oral tradition (*Ibid.*). The latest findings by social scientists like Barnes and Carmichael (2006) also support the already long-standing idea that oral cultures have been underestimated, as compared to written cultures. There is now more evidence that oral cultures can effectively transmit exact knowledge across many centuries and preserve social structures and values.

Romanov's data allowed him to distinguish between sympractical and theoretical cultures (Romanov 2003), the proposal deeply rooted in the cultural-historical tradition:

Sympractical culture – the type of socio-individual interaction involved in transferring skills, knowledge, moral/ethical norms and principals of behaviour in a less verbalized, more visuopractical manner. In sympractical culture the practical and theoretical information is little divided and completely received through personal contacts; for this reason the personal authoritativeness of a source is predominant when such information is retrieved, and the individual reflexion is generally constrained to this authoritativeness.

Theoretical culture – the type of socio-individual interaction involved in transferring skills, knowledge, moral/ethical norms and principles of behaviour through formalized and institutionalized verbal activity, through constructing categorical algorithms and plans – that is, theoretically. In theoretical culture the practical and theoretical information are relatively well-divided and the latter obtained mainly at school. Due to the verbal awareness, there is more individual reflexion in socio-individual interactions and in different types of activity; these, in turn, are more fully realized and more voluntary than is possible within sympractical socio-individual interaction.

In any concrete society both types of culture coexist and dialectically supplement each other through their mutual development and realization.

The works of the cultural historian Vladimir V. Glebkin (2000, 2002) were followed in Romanov's footstep. Exploring texts of Ancient Greece and Mesopotamia, Glebkin traced how 'theoretical thinking' emerged within the more general context of developing a theoretical culture. His conclusions confirm and further support the idea of distinguishing between theoretical and sympractical cultures.

The comparison of socio- and ontogenetic data was one of the cornerstones of Vygotsky's cultural-historical school from its foundation (Vygotsky 1934, 1984c; Vygotsky and Luria 1993; Tulviste 1977, 1991). And the experimental investigations of the historical development of psychic processes were carried out (Luria 1976; Tulviste 1991; see for comments Cole *et al.* 2011; Ponomariov 2013). Following these works, the concept of situational binding will be applied to anthropological, psycho- and palaeolinguistic data in the next sections.

4. Inner Speech Development in Non-School Society

If the thirteen-year-old crisis is possible only as a result of schooling, what characteristics would the inner speech have in the societies where schooling is completely absent? What effect would the absence of schooling have on the behaviour and practices of people in such societies? Particularly, are there concrete examples of transferring of skills and knowledge from one generation to another in a sympractical society? Answering these questions will help to understand some additional aspects of situational binding in relation to the adolescent education in a process of sympractical socio-individual interaction. To approach this aim, the analysis of adolescent initiations and age group institutions in a non-school society will be presented in this section. The initiation procedures have common and specific characteristics in different societies. The comparison of them allows to define the characteristics that are common for the most of non-school societies where the sympractical culture predominates (*e.g.*, Gilmore 1990).

The process of adolescent initiation has usually many stages and unfolds in time for several years in non-school societies. In turn, each stage consists of several phases, the most important of which is the temporal isolation of adolescents from society lasting from several days to the half of year. During this phase under the supervision of adults and older youths, adolescents experience starvation, humiliation, physical impairment and punishments, hurting changes or amputation of body parts, drug abuse and other dreadful practices that are unsavoury even to mention. In different societies and for two genders, the set of calamities is different but their purpose is always the same: to inculcate in adolescents ethical and social norms and to transfer them skills and knowledge (Ponomariov 2009). The training of life-important techniques is deeply interwoven in initiation procedures with the moral restructuring of adolescent consciousness obtained by both emotional and intellectual intervention. The hectic dancing, drum beating, singing and reciting are successfully used for the same purposes in the second phase of adolescent initiation (for detailed description see, *e.g.*, Nadel 1954). The terrific effectiveness of emotional, intellectual and physiological intervention is achieved with adolescents' attention being firmly and constantly held during initiation rituals on sexual and death stimuli.

The initiation procedures should not be torn from age group institutions in societies where they exist. These institutions provide social scaffolding for the borrowing and developing of new psychological skills, besides initiation rituals. Age groups give structure and sense to the process of social interaction. With the help of these institutions, adults create new motives and satisfactions in the zone of proximal development of adolescents, not less than by means of initiations (for comments on Vygotsky's concept of the zone of proximal development see, *e.g.*, Veer and Valsiner 1991). These social institutions make it easier

to transmit skills, knowledge and ethical norms from one generation to another. Let us consider the example from social anthropology.

Social anthropologist and psychologist Siegfried F. Nadel (1954, 1961) made the description of age groups and initiation rituals based on his living for several years among the Nupe of Nigeria.[3] The small societies of those Nupe who did agriculture in the 1930s were strictly divided in age groups or 'age-grade associations', as Nadel called them. People of one age group went from one age grade (class) to the next through initiation procedures. In this sense, the age group is a group of people united by the time of initiation and common interests of everyday life: economic, political, intellectual. Thus, it is not age but the time of initiation that is the main criterion of participation in a concrete age group. Still, the age plays a central role for the inclusion in a concrete age group and it was so particularly in the past when the institutions of age groups were strong. If there were enough adolescents, several age groups in each grade were formed, equal in most respects, but competitive with each other and older age groups in respect of society benefits.

Nadel describes two types of collective labour among the Nupe: *egbe* and *dzolo*. The *egbe* is agricultural work carried out by adolescent members of several age groups. During the work, age groups compete with each other for the title *sode* that will be given to a group that performed best. The *egbe* is accompanied by loud music (playing drums and flutes) and ends with a feast prepared by an adult owner of the field tilled. Adults play a major role in the organization, maintenance and accomplishment of the work, 'Older men stand at the side, watching, criticizing, commenting. Often you can see them call one of the workers by name, exhorting him to ever greater efforts, or shouting impatiently: "Quicker, quicker!" When one field is finished, some of the young men, the captains of the age-grade association among them, will execute a short dance, balancing their heavy hoes in the air and heavily stamping on the tilled field…' (Nadel 1961: 249). Nadel underlines the role of external rhythmic accompaniment for accomplishing the work, linked with the speech practices of adolescent's supervisors and young workers, who 'were shouting with deep hoarse voices at every stroke of their hoe. The speed with which they worked, the whole atmosphere of the *egbe* – the constant drumming, the shouts from audience – had something deeply exciting, almost feverish. I have seen a team of fifteen young men, the oldest between 19 and 20, the youngest 14, clear and till a farm-plot of one acre in two and a half hours' (*Ibid.*).

In contradistinction to the *egbe,* the *dzolo* is collective work performed by the adult members of a Nupe society who come groupwise to each other's

[3] Nadel was a prominent English scientist of Austrian origin in 1930–1950s. He took PhD in psychology and then in anthropology. His teachers were Karl Bühler and Bronislaw Malinowski. The Nupe are one of Nigerian peoples and the Nupe language belongs to West-African Niger-Congo family.

households. There is no music, no competition, no verbal commands or overt speech, and only the preparing of modest food by the host is preserved. All adult members of society can benefit from the *dzolo* while the help of the *egbe* is predominantly reserved for old men and less so for the heads of extended families.

In the examples given, the use of speech and other cultural means can be traced in the cross-generation interaction of the Nupe. The adolescents give themselves external rhythmic signals with their own voice and are subject to the verbal commands of adults. The structure of age groups creates a competition with all the vigor and enthusiasm that it implies, hence the short dances in the conditions of 40–50 °C during the work transfer that would be hard to explain from other perspective. The rhythmic accompaniment with drums and flutes helps to maintain the tempo and force of works. Such cultural tools as adults' supervision, competition, collectiveness, musical tone and rhythm are clearly needed for organizing adolescents' behaviour during the work, because this scaffolding is completely absent when the work is performed by the adult Nupe alone. The self-voice external signals and adults' verbal commands are even more directly point to the character of inner speech processes that occur in adolescence in the non-school society.

All that was said about the inner speech development in the previous sections suggest that there is the developmental lagging of inner speech functions in the non-school society, as compared to the inner speech development in the post-schooled society. The underdeveloped inner speech means the insufficiency of behavioural control in adolescence (see Section 2). If the existence of some cultural tools can be explained by ecological hardship and/or tradition, the necessity of additional speech control more firmly links to the inner psychological processes. But the concept of situational binding makes ecological or other explanations superfluous. The adolescents' work is organized by adults in such a scaffolding system that helps them to overcome the situational binding. The absence of schooling slows the development of inner speech and in the non-school society adolescents cannot effectively overcome the situational binding, *i.e.* they cannot cope with their own physiological state in the physical situation of the work alone. The insufficiency of behavioural control in adolescence is widely discussed in contemporary neuroscience, the data being obtained from schooled samples (*e.g.*, Davey *et al.* 2008; Ernst *et al.* 2006). These data do not contradict to the present discussion but confirm that the degree of self-control is higher in school-based societies.

Furthermore, because the adult Nupe do not use external voice commands, musical and vocal rhythm, competition to overcome the situational binding during the agricultural work, it can be concluded that with advancing age the need for such outer scaffolding system is diminishing even in the non-school society. This system becomes the part of the inner speech control according to

Vygotsky's law of internalization (*e.g.*, Vygotsky 1984c). The developed inner speech has immanent rhythm and continuity, voluntary motives and control that replace external rhythm and voice support, competition and submission to adults. The overt speech and scaffolding, being transformed into the inner speech, become a part of inner organization. In the process of internalization the overt speech loses much of its interpersonal characteristics, but preserves communication, control, and voluntary motives as its basis. Vygotsky analyzed the historical development of inner speech in sociogenesis and even found a similar example (but much less clear one due to the scattered data) of overt speech scaffolding for performance of agricultural works (Vygotsky 1984c: 84; Vygotsky and Luria 1993).

The data about the sympractical nature of learning processes in the non-school society could be supported with many examples from Africa (*e.g.*, Turner 1953, 1957, 1967; Ponomariov 2009) and other world regions (*e.g.*, Gilmore 1990; Ponomariov 2012). It is confirmed by many facts in the works of V. Romanov (2003, 2008), and with many cross-cultural evidences of situational binding (Ponomariov 2013). In the last section, the article turns to the facts that can be explained only from the perspective of the historical development of inner speech and linguogenesis.

5. Historical Development of Language

British linguist Daniel Everett and his wife spent many years living with a Brazilian tribe, called the Pirahã, in remote areas of the Amazon basin. The main characteristic of the Pirahã language and culture is its binding with immediate experience and sympractical context. As Everett notes, 'Grammar and other ways of living are restricted to concrete, immediate experience (where an experience is immediate in Pirahã if it has been seen or recounted as seen by a person alive at the time of telling), and immediacy of experience is reflected in immediacy of information encoding – one event per utterance' (Everett 2005: 622). The immediacy of personal experience, found by Everett, speaks in favour of the limitation of time perspective in the Pirahã consciousness due to the underdevelopment of inner speech. The binding with personal experience in the Pirahã culture and language can be supported by many linguistic examples, presented in Everett's article and in the supplement on the website. As Everett stresses, 'What I propose, again, is that Pirahã culture avoids talking about knowledge that ranges beyond personal, usually immediate, experience or is transmitted via such experience' (*Ibid.*: 623). The analysis of cross-cultural researches allows to find experimental confirmations of the situational binding with personal experience in non-school societies (Ponomariov 2013). This type of binding is fundamentally different from those that were described above on the developmental material.

Summarizing his ethnographic and linguistic data, Everett explains many features of Pirahã culture by the absence of abstract word meanings ranging beyond immediate experience:

> 'Pirahã culture constrains communication to nonabstract subjects which fall within the immediate experience of interlocutors. This constraint explains a number of very surprising features of Pirahã grammar and culture: the absence of numbers of any kind or a concept of counting and of any terms for quantification, the absence of color terms, the absence of embedding, the simplest pronoun inventory known, the absence of "relative tenses", the simplest kinship system yet documented, the absence of creation myths and fiction, the absence of any individual or collective memory of more than two generations past, the absence of drawing or other art and one of the simplest material cultures documented, and the fact that the Pirahã are monolingual after more than 200 years of regular contact with Brazilians and the Tupi-Guarani-speaking Kawahiv' (Everett 2005: 621).

The traditional Pirahã way of life resembles that of other small tribes (some fewer than one hundred members) populating the vast territory of Amazonian tropical forests. But the characteristics of their culture, as outlined by Everett, seem rare and demand further explanation. Such an attempt was made by the psychologist Peter Gordon who conducted several series of numerical test-trials with the Pirahã. Based on his findings, Gordon describes the Pirahã words for counting as follows, 'The Pirahã counting system consists of the words: 'hói' (falling tone = 'one') and 'hoí' (rising tone = 'two'). Larger quantities are designated as 'baagi' or 'aibai' (= 'many'). <…> Of particular interest is the fact that the Pirahã have no privileged name for the singular quantity. Instead, 'hói' meant 'roughly one' or 'small', which precludes any precise translation of exact numerical terms' (Gordon 2004: 496–498).

Gordon refers to Whorf's (1956) hypothesis, of which there are two versions: (1) the type of language you speak *influences* the way you think (the weak linguistic determinism); (2) the type of language you speak *determines* the way you think (the strong linguistic determinism). Discussing the results of his experiments, the scientist supports the strong version:

> 'The results of these studies show that the Pirahã impoverished counting system limits their ability to enumerate exact quantities when set sizes exceed two or three items. For tasks that required additional cognitive processing, performance deteriorated even on set sizes smaller than three. <…> The present experiments allow us to ask whether humans who are not exposed to a number system can

> represent exact quantities for medium-sized sets of four or five. The answer appears to be negative. The Pirahã inherit just the abilities to exactly enumerate small sets of less than three items if processing factors are not unduly taxing. <…> The present study represents a rare and perhaps unique case for strong linguistic determinism' (Gordon 2004: 498).

Agreeing with Gordon that the Pirahã neither count nor understand the concept of counting, Everett offers an alternative explanation, 'Gordon (2004) alludes to a Whorfian approach to the matter by claiming that Pirahã's lack of counting might derive from their lack of number words, but many societies in the Amazon and elsewhere have borrowed number words as they develop economic ties that require numerical abilities. The hypothesis of this paper, which explains both the lack of counting and the lack of borrowing, is that Pirahã's counting 'deficiency' and their failure to borrow number words (in spite of commercial contact with Brazilians and in spite of borrowing their pronouns) are due to cultural constraints' (Everett 2005: 634).

Thus, if Gordon explains his findings from the perspective of language constraints, Everett points to cultural constraints. But both culture and language are created in a semantic field of speech; they are not parallel processes (Vygotsky and Luria 1993; Cole 1985). The same is true of Whorfian parallelism between language and thought. Famous psychologists Patricia M. Greenfield and Jerome S. Bruner, who conducted cross-cultural studies confirming some of Luria's findings, evidence, 'We have asked first the naive question: where in a culture should one find differences in the processes of thought? The anthropological linguists (*e.g.*, Whorf) suggested a concrete answer: where there are language differences, there may (or should?) be cognitive differences. Our results have led us away from the parallelism of Whorf toward the instrumentalism which is more typical of Vygotsky (1961) and Luria (1961)' (Greenfield and Bruner 1966: 91). Language cannot be regarded only as a cultural phenomenon or only as an individual one. Not only language and literacy influence the development of speech but the latter has a deep impact on the linguogenesis via the development of operations with word meanings. And the linguogenesis is an axis of cultural development.

Vygotsky experimentally proved that the operations with word meanings are developing in ontogenesis and he tried to find as many evidences as possible that this process occurred also in sociogenesis (Vygotsky and Luria 1993). His experimental research showed that there are *three major stages* in the development of operations with word meanings: proper names, complexes, and concepts (Vygotsky 1934). Each of these stages comprises a different system in the development of the semantic field of speech. The Pirahã speech and thinking are so bound to the non-abstract system of operations that it is mostly in-

compatible with system of other languages based on more abstract operations. The development of language and the development of speech is a mutual process and each stage of this process means the gradual overcoming of situational binding (Vygotsky 2001). Therefore, it can also be said that a different level of liberation from situational binding constitutes a main impediment for Pirahã's understanding and borrowing of systemic operations with word meanings from other languages. These speech operations can radically differ in different languages correlating with a level of word meaning development and a degree of the situational binding of language speakers.

It does not mean that the Pirahã cannot develop their speech operations to make them more compatible with those of other languages. To achieve this, they have to change both their cultural practices and the verbalization of these practices – the processes, which go hand in hand. But as Everett's experiment of practical teaching proved, the Pirahã adults could not change to different speech operations because the sensitive period for language acquisition is over. But if the Pirahã child were in the bilingual situation from the birth, the language with more developed speech systems would take more preferable position in her/his consciousness. This adds one of the reasons why many peoples in history changed to radically different languages, when exposed to the bilingual situation with more developed speech systems, and why some contemporary languages continue to die.

The historical development of psychological operations with word meanings was also understood by Vygotsky as 'the historical development of language' (Vygotsky 1934: 263). His conclusions may raise some doubts because they were the result of extrapolation of experimental ontogenetic findings on the data obtained from ethnopsychology and anthropology of the beginning of the 20th century. Verifying his position with new data obtained from neuroscience, neurolinguistics, cross-cultural psychology and anthropology, A. R. Luria supported it many years later (Luria 1976, 1981). Besides being confirmed with contemporary psychological and ethnolinguistic data, linguogenesis can to some extent be verified by current palaeolinguistics.

The assyriologist Igor M. Diakonoff (1995) notes that there is a shortage of words with abstract meanings in archaic languages and that is the reason why less abstract meanings were initially used as a trope (*i.e.* metaphorically, metonymically) to express more abstract meanings. For example, in the Sumerian language, on the base of which one of the earliest writing system was developed after 3000 BC, 'tenderly' was written *mí-dug,* (*i.e.*, 'to speak like a woman'); 'open' was written *ik-kid* (*i.e.*, to push a door), even when it was referred to an opening of a trade route from one sea to another; 'to kill' was *sang-ngiš-rah* (*i.e.*, 'to strike the head with a stick'), even when a different way of killing was described; 'wise' was *ngeštu(g)-sum-(m)* (*i.e.*, 'having the ear'); 'in front

of' was *igi* (*i.e.*, 'the eye'); 'liberation' was *ama-r-gi* (*i.e.*, 'coming back to mother'), *etc.* (Diakonoff 2004: 24–40).

Though Diakonoff gives many sophisticated examples from different ancient languages, demonstrating how the first abstract meanings were gradually formed in a non-linear way, further studies are needed to obtain a detailed picture of language development (cf. Romanov 2008). Diakonoff's examples only in the first approximation show how abstract meanings were created with the help of less abstract ones. But they implicitly suggest that the expressing of abstract through tropes generated many metaphorical associations, 'Such tropes as a consequence of their wide associability can induce further tropes, producing semantic chains, bunches, and the whole semantic fields' (Diakonoff 2004: 39). Verifying many historical and linguistic data by some psychological and physiological findings, Diakonoff suggested that science and art were not divided, when the first systems of writing appeared. This explains why the most ancient texts are full of poetry and emotionally loaded semantic chains.

Diakonoff's conclusions about the functioning of word meanings in archaic languages are close to those formulated at the beginning of the 20th century (Cassirer 1955; Frank-Kamenetsky 2004), although based on much more extended and better-verified linguistic material from several ancient languages, and consulting the works of other palaeolinguists that has since appeared. They are consistent with Vygotsky's ideas of historical development of language, or linguogenesis, and confirm Everett's arguments that there can be languages with the shortage of abstract word meanings. From the perspective of inner speech development and the overcoming of situational binding, they sound even more plausible.

The main reason for both linguogenesis and inner speech development lies to some extent in the necessity to control one's behavior more effectively and rationally. For example, when preparing a lecture, classes or public speech, we can elaborate the whole future monolog in our inner speech. In the semantic field of inner speech a schooled individual can produce prolonged and emotionally intensive dialogues with oneself trying to reach that or other behavioural decision (Ponomariov 2012: 126–134). The schooled individual can write down or remember his own monologic or dialogic inner thoughts to check introspectively their logic or absurdity, morality or ugliness – that is what is referred to as reflexion, or metacognition. Now let us ask whether an individual without school education can effectively maintain these speech processes? All the data regarded suggest that the inner speech of unschooled people has much more reduced and fragmentary character than that of schooled ones. To check this hypothesis, the complex neurobiological study of unschooled individuals' inner speech along with psychometric measuring is necessary.

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