

Conference Paper

Space and Time in Neuropsychological Studies: History and Modernity

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Abstract

The content of the category of chronotope in biology, philology and psychology is revealed. The connection of approaches to the analysis of the interrelation of space and time in the concepts of V. Vernadsky, A. Ukhtomsky, N. Bernstein and M. Bakhtin is shown. It is state that common for all this concepts is the aim to analyze the integral response of the organism to the effects of the external environment. It is shown that Ukhtomsky's complex approach to heterochrony of chronotope is correlated with the complex structure of the psychological chronotope, in which three parameters of space as well as three parameters of time are distinguished in the objective and subjective reality.

Heterochrony is especially important for neuropsychology. Considering the chronotope in the context of brain work, scientists discovered the facts of heterochrony, heterotopy and hetero-dynamicity of development. It is connected with the fact that mental functions begin to develop at different times and are formed at different speeds and in different areas of the brain. Spatial-temporal determination of ontogeny is important for the differentiation of normal and abnormal development, for determining the type and nature of mental dysontogenesis, for psychosomatic studies. This makes it possible to talk about the cerebral substratum of the chronotope as a spatial-temporal factor of the psyche, which, undoubtedly, requires further research. In the psychology of personality the chronotope gives the possibility of a holistic approach to the analysis of person in the changing reality of space-time. It is extremely important for investigating the processes of socialization and the identity formation in transitive reality.

In conclusion it is states the possibility to understand the concept of "psychological chronotope" as a construct that connects different approaches and paradigms to the development of person in a modern changing society.

Keywords: chronotope, space, time, psychology

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1. Introduction

The category of chronotope today is increasingly attracts the attention of psychologists (Martsinkovskaya, Balashova, 2017), although this concept appeared in science at the beginning of the last century.

It seems that in psychology the chronotope can be analyzed in two ways. First of all, it is a fundamental category that reveals the basic determinants and mechanisms of certain phenomena of the individual and collective psyche, opening up new aspects in them. The chronotope also can be considered as a complex psychological reality, connected with the work of the brain and having a certain morpho-functional substrate.

It is necessary to emphasize that the category of the chronotope is not just a statement of the spatial and temporal characteristics of the situation, text, picture, theory, etc. It is a method of constructing a highly differentiated and, at the same time, integrative image of the vital, creative and scientific reality. Therefore, for psychology, it is necessary to reveal the possibilities of internalizing this category in the context of the diverse methodological paradigms of modern psychological researches.

2. Psychological Chronotope – New Methodology

The concept of the chronotope as a connection of space-time was first presented in science by the famous Russian physiologist A.A. Ukhtomsky (possibly influenced by the ideas of A. Einstein and G. Minkowski about the unity of space and time) ([22], p. 347). He believed that the linkage in time, in speeds, in the rhythms in the performance of individual elements of actions, is formed by the functionally defined "center" [22]. Ukhtomsky first introduced this concept to explain human behavior as a holistic system that reacts to the impact of the environment. He stressed that "from the point of view of the chronotope, there are no longer abstract points, but alive and indelible events of human being" ([22], p. 342).

Methodologically it is important to trace the connection of A.A. Ukhtomsky's ideas with his own concept of dominance, as well as with the concept of level-building movements of N.A. Bernstein [5] and with ideas about the biosphere and noosphere worked out by V.I. Vernadsky [7].

For the development of the Ukhtomsky's concept very important was the Bernstein's theory about different levels of organization of movements, in which it was proved that the organism reacts precisely as an integral system and precisely on the general situation in which both time and space are combined. Not without reason Bernstein [5]

called his concept levels of movement, emphasizing that a person builds his behavior, but does not responds to a stimulus. And in construction, the place at which this process takes place and its time are always taken into account.

The construction of his activities a person coordinates with the degree of importance of the objects surrounding him. These objects, naturally, also are located in a certain space-time continuum and in the space-time hierarchy. Thanks to this hierarchy, these or other objects focuses the person's attention, form a dominant on this object. The theory of Ukhtomsky's dominant is widely known, so it is no interest to dwell on its description in detail. But it is necessary to emphasize the importance for Ukhtomsky the dominant on the face of another people [22]. After all, communication with others occurs within a certain time and in a certain place, and the dominant for different persons, more precisely, the choice of the object (person) for this dominant, is closely connected with space and time as a coherent system. This integrity was always implicitly known in the psychology of communication.

It should be emphasized that in Ukhtomsky's concept, not only time and space were combined. There was the unity of the natural and artificial environment as an integral system of the external world and, above all, of surrounding people. The discrepancy between temporal and spatial coordinates in people's lives is also associated with mismatch of their life in the biological and sociocultural world, in the biosphere and the noosphere.

This brings us back to the notions of the biosphere and the noosphere of V.I. Vernadsky. Vernadsky stressed that with the advent of people, their mind, the entire route of our development changes, since man's knowledge creates a noosphere that changes our life, transforming our planet. In this case, unity, according to Vernadsky, is not only the unity of man with living nature, but the connection of all elements of animate and inanimate nature into a single whole. At the same time, the stages of development from his point of view can be described as civilizational epochs but not only as the emergence of new forms of life, rising from the irrational to the rational, conscious life [7].

The relation of man to reality unites different spaces and times, fusing into the unique integrity all person's life. And this brings us back to another well-known concept of the chronotope - the literary chronotope of M.M. Bakhtin.

Thanks to the creativity of M.M. Bakhtin, who understood the chronotope as an essential interrelation of temporal and spatial relations, this concept is firmly established in such humanities as literary and cultural studies. The analysis of the chronotope enabled Bakhtin to reveal the world-image in different historical periods [4]. At the

same time, we can say that Bakhtin's chronotope is somewhat simplified in comparison with the concept of Ukhtomsky's chronotope, because it always has binary oppositions of space and time. It must be noted that Bakhtin also wrote about so-called small chronotope, which give possibility to predict the further development of the temporal course of the plot in the space.

3. Heterochrony of Chronotope

An important question is which of the components of the psychological chronotope plays in it a leading role - time or space? Many scientists (Ukhtomsky, Vernadsky, Bakhtin and others) believed that the leading role belongs to time.

If Vernadsky wrote about the mismatch of the natural and social world, and Bakhtin about the mismatch of large and small chronotope, Ukhtomsky, emphasized the heterochrony, mismatch, the gap between time and space. At the same time, when analyzing heterochrony one must take into account the fact that not only space is not homogeneous, but time is also relative. Thus, today we need to speak not of a two-dimensional chronotope, but of a four-dimensional continuum. About the four dimensions in the description of the world said at the beginning of the last century G. Minkowski.

In the Minkowski world, the position of the body can be determined by four quantities: three spatial and one temporal. From his point of view, space and time do not exist separately from each other. Real events take place simultaneously in space and time. But, continuing Minkowski's view, if we talk about the three-dimensional space of reality, then time also has three-dimensions - past, present and future. In virtual space we can talk about a significant expansion of the chronotope, as well as the increase of its heterochrony. At the same time, the need to harmonize the chronotope is growing, because heterochrony does not allow a person to link together certain segments of his life path. This statement relates us to psychology, the integrity of identity.

4. Category "Chronotope" in Developmental Neuropsychology

In the works of L.S. Vygotsky and his colleagues clearly traced the idea of heterochrony of development of mental functions, i.e. that different mental processes begin to develop intensively at different times [9, 10]. In recent decades, researchers begin

to talk about of heterochrony, heterotopy and hetero-dynamicity of development, because mental functions not only begin to develop at different times, but they are forming at different rates and in different regions of the brain [13, 17]. In neuropsychological studies of early ontogenesis, numerous facts confirm us that the functional development of the brain space as a whole and its individual components possesses several vectors of temporary deployment [15, 21]. For example, the right hemisphere in childhood is slightly ahead of the left in development; middle subcortical structures outstrip development of posterior (parietal, temporal, occipital) parts of the brain; the formation of the prefrontal regions of the cerebral cortex occurs later than others. One can see heterochrony and heterotopy in the maturation of brain structures that provide such an important aspect of mental activity as interhemispheric interaction. It is interesting that during normal (physiological) aging, as a rule, manifestations of a certain decrease in the level of functioning of the subcortical structures and the right hemisphere of the brain are the first to manifest themselves [12]. In the data obtained in these studies, we see a real picture of the chronotope as a spatial-temporal organization at the functional and cerebral levels.

The idea of spatial-temporal determination of the ontogenesis is also important for the differentiation of normal and abnormal development. Thus, in children's psychiatry and pathopsychology was shown that a particular symptom can have a different meaning depending on the age at which it occurs [11, 13]. It is important to emphasize that in modern psychology of anomalous development, space and time are regarded as the leading parameters, without which it is impossible to fixate the type and the nature of mental dysontogenesis. Thus, V.V. Lebedinsky wrote about the need to determine the functional location of the injury. It can be local or general, associated with violation of subcortical and cortical regulatory systems [13]. Underdevelopment, delay or damage depends both on the time of the function's occurrence in ontogeny, and on its preferential connection with subcortical structures or cortical areas of the brain [13].

The chronotope is also significant for psychosomatic works. It is the time (in particular, the age of the patient or the stage of treatment) that plays an important role in determining the content of the internal picture of the disease [19].

The analysis of neuropsychological researchers gives the possibility to raise the question of the cerebral substratum of the chronotope as a spatial-temporal factor of the psyche. Of course, this problem is still far from being resolved. First of all, because in Luriev's neuropsychology, priority always belonged to space and the study of the brain organization of perception of time was represented extremely fragmentarily [1].

Nevertheless, today it is possible to state that some brain zones are more or less responsible for processing both spatial and temporal information. This, first of all, refers to the temporo-parieto-occipital region of the left hemisphere of the brain. It is known that when this zone is affected, a so-called semantic aphasia and the understanding of various logical and grammatical constructions are violated [14].

The injuries of the postero-luminescent regions of the brain lead not only to disorders in the temporal development of various mental functions, but also to decrease in spatial memory, the spatial organization of arbitrary movements, and the correctness of the localization of objects in space [2, 20]. The pathology of the medio-basal parts of the frontal lobes of the brain is connected with the disorientation in place and time, associated with memory disorders. Investigations of late depression showed that changes in time perception reveals statistically significant correlations with a deficit of some spatial functions [18].

Finally, it must be mentioned that a complex analysis of different-level functional asymmetries allowed to neuropsychologists create an original integrative model of the spatio-temporal organization of the brain and psyche [6]. According to this model, space and time are described through the psychic processes and the connection between the right and left hemispheres with various aspects of space and individual time is assumed.

We have outlined only some of the vectors of modern psychological researches in which the category of the chronotope "sounds" hidden or explicitly. There is no doubt that the range of such studies will continue to expand in the future, primarily because it is this very category that is a subtle instrument for the analysis of increasingly complex and changing psychological realities.

5. Psychological Chronotope

The main characteristic that differentiates the psychological chronotope from the biological (Ukhtomsky, 2008) or literary [4] is the emotional component, which is the leader here. Thus, the main element of the psychological chronotope is emotional attitude to person's objective and subjective place in entire space and time. This complex construction in unchanging periods is relatively stable and for a person his time and space correspond with the social time and space. In a transitive society, there is a great heterochrony between the personal and social components of the chronotope. Objective and subjective time and space do not coincide with each other. Thus, heterochrony can occur in all aspects of the chronotope. Separation of time from space

creates emotional discomfort. The cognitive component the gap between personal and social space and time does not compensate. That's why emotions begin to determinate the development of psychological chronotope.

Empirical data show that the expansion of social space leads to the changes in personal space, self-image, and temporal borders [16]. These materials were confirmed in researchers of differences in perception of social space and time among adolescents living in different cities. It was shown that teenagers from small settlements orientate on social space and personal time. In megacities, on the contrary, teenagers prefer personal space and social time [23].

One of the most actual problems today is to analyze the determinations of relationship between objective and subjective aspects in the integral construct of the psychological chronotope. To some extent, it is possible to associate personal components of the psychological chronotope with small chronotope of M.M. Bakhtin, while the whole chronotope is more correlated with the idea of the integrity of people's behavior in the biosphere and the noosphere of A.A. Ukhtomsky and V.I. Vernadsky. It can be said that separate segments combine into a holistic chronotope of life, its localization in time and space. Emotional experiences mark not only different lines of the chronotope, but also its heterochrony, showing the divergence between personal and social space-time

6. Conclusion

The presented materials prove the adequacy of using the concept of "psychological chronotope" as a construct that connects different approaches and development lines in a modern changing society. Violation of the consistency in a large space-time continuum leads to its violation in a small, and we must stress that harmonization / violation of the balance of social / personal chronotope is coincide with the balance of different types of identity. At the same time, sustainable interests, motivation and values can act as a factor that structures all aspects of chronotope.

Thus, for a psychology of modern transitive society, a psychological chronotope can help in analyze of determination and directions of person's development. Harmonization of the chronotope can be considered as the harmonization of the identity, the acquisition of a unified identity and positive attitude to the environment. At the same time, it is necessary to emphasize that the heterochrony of the psychological chronotope, like any disturbance of homeostasis, increases the intentionality, sets the directions of development. Therefore, it is necessary to analyze individual variants of

the development of the psychological chronotope, which help the socialization and self-realization of people.

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