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Spatial self image at an early age: structure and diagnosing

Abstract

The article reviews the basic form of physical self-awareness, in particular, a spatial self image and its most important feature, the nature of boundaries between the world and me. Among major sources of a spatial self image are: the physical sense of bodily boundaries, kinesthetic sense and sense of balance which altogether define the quality of bodily self-awareness and mediate the relationship of the child with the environment. Basic physical senses are considered in interaction, complementarily and mutual influence, as they form collectively a spatial self image interpreted as the highest mental function. The phenomenon of the physical body boundaries is regarded as a key feature in self-perception, the premise and the trait of interaction with surrounding objects and environment in early and preschool age. We have described an experimental method of diagnosis of spatial self image and the nature of physical boundaries. A key feature of the method is the fact that diagnostics situations are natural and not prescriptive, and the diagnosis itself is compact and held in a form of a play. Diagnostics method, in particular, uses rhythmic tactile-motor games based on thorough psychological analysis. The research revealed a link between the nature of physical body boundaries and the level of spatial awareness development and the level of children's psychological development. We have identified the most common trends in formation of body boundaries have provided their qualitative characteristics. The article explains the relationship between the perception of the body surface and a most essential indicator of development, the line between the world and me.

Keywords: self-awareness, spatial self image, sensorimotor development, bodily boundaries, balance, sense of touch, sense of self-movement, sensory-motor games, tactile-motor games, sign games, imitation, tactile contact

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Introduction

The concept of a spatial self image

A lot of children today have certain developmental disorders. Attention deficit disorder, delays in speech, motor, emotional and volitional development occur far more often than 20 years ago. According to neurologists and neuropsychologists,[1] deviant development syndrome (without clinical pattern) is observed in over 70% of children in the first seven years of life. It has been noted that various types of deviant development in children appear in the character of a child's movements, in his or her sense of rhythm. It is believed that early mental and physical development is associated with a sense of body, with formation of self-boundaries. A child who feels poorly his or her body does not control own movements and cannot focus on perception of external events and internal sensations. This inevitably affects the child's substantive activity and contacts with adults and peers, as well as the baby's general activity.

Research shows that school education difficulties are related to problems with a comprehensive and differentiated perception of physicality which serves the starting point of all space-subject manipulations.[1–5] This is reflected in an unformed body scheme or image, and, in particular, in basic bodily senses, i.e. a sense of balance, kinesthetic and tactile senses, which generates a variety of space-time violations in writing, reading, etc., as well as an inability to control movement and rest. We define as a *spatial self image* the feeling of oneself in the boundaries of the body and in external environment, including the perception of physical boundaries, one's own activity and integrity. Spatial self image is not an innate function; it arises in the course of motor and sensory experience associated with a child's interaction with close adults. It is most intensely formed in early childhood when children are mastering environment and their own sense of bodily self increasingly more actively and independently. The modeling of a spatial self image starts during the period of infancy. In the first six months of life an infant perceives his or her own body as an external object. The phenomenon of babies playing with their hands is widely known: they see them, pull them in their mouths as an external object. And just as the baby develops hand movements and starts managing the limbs more consciously, they cease to be external objects and become "friends". Interestingly enough, during the next six months the hands are already adopted, and the legs remain an external object — the baby is now trying to grab them, is examining them and is taking them into the mouth. With the start of independent movements and upright posture the child's limbs become a means of action and cease to be an external object. Thus, we can literally observe the process of the babies exploring their body as a universal means of their own livelihood and self-realization.

The child's communication with close adults plays a crucial role in the development of self-awareness. It is not only an emotional contact that an adult establishes with a baby, but also a physically one — in the process of taking care and nurturing the adult strokes, hugs, shakes, reacts to movements and sounds made by the baby, thus allowing the baby to feel his body, to confirm its existence and self-identity. The perception of bodily awareness is most intensely formed with the start of moving around independently when motor activity

increases and the body becomes an instrument of movement and action. Independent moving around allows the child to increase and to diversify practical contact with the outside world. This contact has two directions: outwards (getting acquainted with the outer world) and inwards (mastering own body). First and foremost, the baby has to feel himself in the outside world, to feel his movements and his bodily contacts with the outside world. We can assume that self-perception in the boundaries of one's own body is a form of *self-awareness* and is a transition between non-differentiated sensations of one's sense of bodily self to formation of a comprehensive spatial self image.

A spatial self image is linked to *self-separation and self-isolation from the outer world, with developing the boundaries between me and not me, Me and the world.* It is not having an idea of one's appearances, it is feeling one's body from within which is essential for keeping an integral and separate Self.[6–8] Research of sensory deprivation shows that people unable to move during the day actually lose the feeling of self in the absence of external stimulation. According to the American psychologist Gordon Allport, the sense of bodily self remains a lifelong anchor for self-awareness [7; C. 245].

The starting point for our work was the concept that structure of a spatial image includes three components: feeling of the boundaries of the body, experiencing one's activity and feeling one's integrity, stability in space. Therefore, we assumed that a spatial self image develops on three basic bodily senses: a sense of touch, a sense of own motion and a sense of balance.

The sense of touch (tactile sense) gives the feeling of the boundaries of one's own body, self-separation and self-isolation, distinguishing between Me and not me.[2–9] This sphere is closely connected to the emotional sphere and a sense of security, with developing of affection and trust between a child and an adult, developing a sense of self-identity, the physical boundaries of self and personal space boundaries.

The boundaries have two functions at a time: on the one hand, they separate the subject from the environment; on the other, they ensure a connection with the external, sensitivity, susceptibility to external influence (communicating function). Traditionally, the sense of touch is regarded as a gnostic function — a manual, haptic perception. However, the mentioned phenomena together with the research data [3,9,10] give us grounds to speak about general bodily tactile self-perception. Deviations in tactile (touch) self-awareness in children are reflected in hypo- or hypersensitivity to touch, insensitivity to their location, loss of the sense of security, etc.

The sense of self-motion, proprioception allows to perceive oneself as a source of motion and to manage one's activity freely. Perceiving one's actions by a person is an essential condition of the action itself and the source of the sense of one's own activity. The main form of expressing one's activity at an early age is moving and substantive actions.

In case of insufficient motion capabilities or their limited managing (including athetosis, cerebral palsy, paresis, ADHD) a serious deprivation develops.[6,11,12]

The sense of balance reflects perception of the whole body position in three-dimensional space. The sense of balance gives the feeling of stability and wholeness of self. It turns on with every change in body parts position — while rotation, moving in a horizontal or a vertical direction.

A child with gravitational insecurity feels any movement or change of position as a threat to his security.[9,13] The described bodily senses have repeatedly been the subject of study in the Russian psychopathology and neuropsychology but were considered separately and in relation mainly to pathological states. In this paper, they are regarded as structural components of a holistic self image developed in early ontogeny. Each bodily sense plays its role in developing and functioning of a spatial self image. A spatial self image in its turn is an integrative formation in which all its components are connected into a single unit.

Thus, *we defined self-perception within the boundaries of one's own body in space, including the sense of one's bodily boundaries, one's activity, integrity and stability as a spatial self image (SSI).* The most crucial period of developing a SSI falls on early age from 1 to 4 years when a child is increasingly more active and independent in mastering the outer space and his own physical capabilities. Not always does this process go successfully. Due to mass limited sensorimotor experience of modern children (congenital immaturity of the central nervous system, low mobility, prevalence of gadgets, etc.) many of them demonstrate disfunction of basic bodily senses formation and of a spatial self image which affect their future development. In this regard, it is vital to timely detect and correct such deviations. In order to do so, it is required to create a skilled technique of diagnosing a spatial self image at the stage of its developing.

The technique of diagnosing a spatial self image in an early and preschool age

The main subject of the SSI diagnostics is bodily senses. When developing the diagnostics, we sought to create situations natural for young children in which bodily senses reveal themselves the most.

The sense of touch appears most clearly during *manual inspection*: it is the hand that is the leading organ of tactile perception. Along with this, we have identified *general bodily sense of touch* which is manifested in feeling a tactile impression all over the body. *The manual sense of touch* was observed in a situation of the Wonderful bag when children were touching invisible objects of round shape and recognizing a barbed cone, a smooth ball and a soft ball among them. *General bodily sense of touch* was observed in a diagnostic situation of the game Dough played on the adult's lap with the adult's hands in close contact with the child's body (kneading, stroking, pressing, etc.). This was the final test of all, as it required the child's trust to the adult and to the situation.

The sense of self-motion is the second indicator of a spatial self image. We have identified three key spheres where the sense of self-motion manifests itself:

1. *General motor agility and fitting into space*
2. *Willingness and ability to imitate*
3. *Operational agility while working actions with tools*.

Motor agility was observed in a situation of free movement in a three-dimensional space. The child is invited to move in a circle using a certain organization of space made from subject modules (slide-hole-bumps-bridge). The child's willingness and ability to imitate revealed itself in a musical-rhythmic-sign-motor game in which the lead would sing or recite poetry displaying the meaning of a certain scene by typical expressive gestures, and the children would reproduce his gestures in their turn (sitting or moving in circle). The sense of self-motion

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is directly linked to imitation in the process of which exteriorization occurs, i.e. appropriation of the observed actions and understanding of their meaning, while reproducing them all the more consciously. Operational agility manifested itself during the Bowl-spoon test. The test consisted in transfer of habitual actions into unusual conditions: the child would pour slippery beans from a small bowl into a smaller one with the help of a spoon. The test Dynamic toy revealed understanding of the meaning of tool actions with elements that would set the toy in motion (a swinging suspension in pecking chicken, hammerer's planks movement and others of varied difficulty).

The third indicator of a spatial self image is the *sense of balance* which provides stability when interacting with support, centricity while changing the position in space. Two areas of display were identified for the sense of balance. *Active balancing* while independent moving on surfaces of various heights when the child entered in a situation of possible imbalance (Steps-bridge situation) and *reactive balancing* in response to losing the grounds caused by the adult in the game Following an even path (Swinging situation). Diagnostics is carried out in two stages: in group games (Sign games and moving around in an organized space) and individually (all the other tests). Two key characteristics were recorded and evaluated for each indicator of a spatial self image:

1. *Proactive attitude* which is expressed in specific impressions orientation, in the pursuit of certain actions or sensations, in their intensity, energy, longing for repetitions.
2. *Efficiency* which is expressed in sensitivity to tactile, motor and vestibular impact, in a success rate of the child's actions in a particular test, in their variability and independence.

On the one hand, the aforementioned characteristics are the source of bodily senses formation, on the other, a sign of their development. Proactive attitude and efficiency were rated on a 4-point scale where 0 means totally absent and 3 are clearly demonstrated. The maximum total figure for all tests could reach 120 points. The total score for each metric (sense) reflects the level of development of a particular sphere of spatial self-awareness which could be interpreted as high, medium or low. The final sum in all parts of the research shows the extent to which a spatial self image (SSI) is developed. In addition to qualitative characteristics, the qualitative ones were also evaluated, such as the nature of the bodily self boundaries which were defined by the intensity of the separating and communicating function of the boundary. In total 119 children aged 1.6 to 4 years (59 girls and 60 boys), participated in the diagnostic research, they were divided into two age groups: the younger group aged 1.6 to 2.5 years and the older group aged 2.6 to 4 years.[14]

The results of the diagnostic examination: the level of development of a spatial self image

The level of development (well-formedness) of a spatial self image demonstrates the overall picture of the child mastering his or her own bodily institution — the development of the sense of own motion, the sense of balance and of touch. It is defined based on the sum of the characteristics in all parts of the diagnostics. Three levels were pointed out: high, medium and low.

A high level of development is observed in cases when children are proactive, responsive and quite independent. Such children react positively and effectively to various types of impact during tactile sense tests. They fit in space and subject conditions well during self-motion sense tests; they are willing to be incorporated in situations of imitation. They are calm and open to experience during balance tests; they balance the whole body in a timely and flexible manner. For toddlers aged 1.6 to 2.5 years the high level ranges from 84 to 108 points and for children aged 2.6 years and older—98 to 120 points.

With a medium level of spatial self-awareness we observed uneven results in different spheres. Pro-active attitude and focus on different experience is unequal. Such children are predominantly active during self-movement sense tests but may miss some space objects or elements of sign games. They compensate for imbalance inaccurately or with a delay and need a safety net during balance tests. For toddlers aged 1.6 to 2.5 years the medium level was estimated at 54 to 84 points, for children aged 2.6 years and older— 60 to 97 points. Children with *a low level* demonstrate low results in focused activity and bodily senses development in each sphere of the research. Such children avoid many actions and effects during sense of touch tests; their motor activity is not related to the task in any way. During self-movement tests fitting in space show a dramatic decline, children do not account for the environment, bump into objects, and their imitation is occasional and feebly expressed. During balance tests such children are highly insecure, they hold on to the safety net tightly. The unpredictability or absence of visual control can reduce their activity to zero. A low level of a spatial self image development was recorded in cases when the total figure was below 53 points for toddlers and 59 for the older group of children. Following the diagnostics testing the results in terms of development of a spatial self image are as follows: 27% of children have a high level, 49% — medium, 25,5% — low level (in the total sample). We observe significant differences in the older and younger age groups in terms of the distribution of the SSI levels (Figure 1). While the younger group has quite an even distribution, with aging the proportion of children with a high level drops almost three-fold, the proportion of children of medium level increases nearly twice and the proportion of low level reduces just by a third.

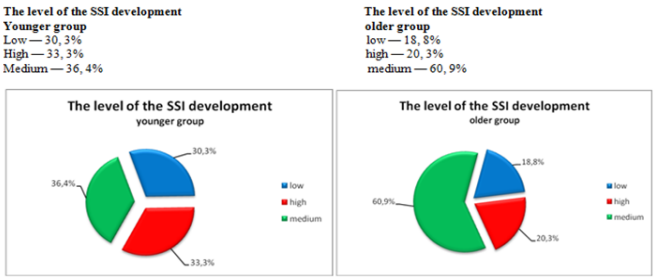

Figure 1 The level of the SSI development in the younger and older age groups.

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The results of the diagnostic research: the nature of the boundaries between the world and myself

As noted above, the qualitative nature of the bodily self boundaries is determined by the ratio of the separating and communicating function of the boundary. The boundary functions reflect the extent of the child's sensitivity to various impacts and were determined not only in the sense of touch tests, but also in other diagnostic situations.

The following types of *nature of self-boundaries* were identified:

1. *Balanced bodily boundaries,* i.e. an equal level of expression of their separating and communicating functions. The indicators of activity and efficiency of each of the three bodily senses are more or less equally manifested. Our sample had 47.22% of children with balanced boundaries with there were 37.14% in the younger age group and 51.6% in the older group.
2. *A weakened separating boundary function* - thin boundaries. Children with such a type of boundaries are characterized by high sensitivity with decreased motor and general activity. Such children are extremely cautious, passive, they avoid unexpected experiences. All that is connected with the unknown (loss of support, absence of visual control) causes insecurity, lowers activity until refusal. During manual touch sense tests the child is afraid to put his hand inside the bag. During the Dough test game the children avoid direct bodily contact or only allow a very mild touch. During balance tests the children are excessively cautious, they try to avoid situations of imbalance, and they may react with anxiety and negative emotions to changes in the support stability. For some of the children even slight shaking causes grasping, leaving and crying. It is noteworthy that susceptibility in situations of imitation and during operational agility tests proves to be rather high. Our sample had 25.77% of such children (40.0% in the younger age group and 20.31% in the older one).
3. *Weakened communicating function of the boundaries* — thick boundary. With this type of boundaries a decreased sensitivity is observed which is sometimes combined with an increased activity. In free movement the child can demonstrate high mobility with a lack of motor agility — moving clumsily, awkwardly, may accidentally touch or knock down elements in space. Imitating movements are highly inaccurate. Operational skills are low, the children are insensitive to spatial properties of the object, cannot adjust their movements to it, acting awkwardly and at hazard. Low sensitivity to changes in body and support position during balance tests. Regards own negative experience (stumbled, missed) with indifference, reduced self-correction of motor inaccuracies. Reacts primarily to intense touch during sense of touch tests, does not notice those of moderate and mild intensity. Such children comprise 22.65% in the total sample, namely, 20,0% in the younger age group and 23.4% in the older group.

The research revealed another type of combination of the separating and communicating function of the boundaries that we called *dissonant*. It is characterized by extreme sensitivity to some stimuli amid ignoring others, or a situational response to the same objects and impact. Thus, for example, along with masterly gross motor skills such children can have undeveloped focused movements and almost no imitation. Largely, those were children with emotional disorders or with experience of derivation. Our sample revealed 4.12% of such children, with one child in the younger group and three children in the older age group. Their diagnostic was of a certain complexity, as they had great difficulty entering in a meaningful dialogue. It is worth mentioning that only an intense tactile impact on the whole body increased their engagement in interaction with the adult. Remarkably, toddlers of the younger age group are more likely to have excessively thin boundaries, while children of the older age group reveal a tendency to thickening the boundary. It can be assumed that a thin boundary is a condition for high susceptibility to contacts with the outer world, including relations with a close adult, and it can indicate specific character of boundaries in ontogenesis (Figure 2).

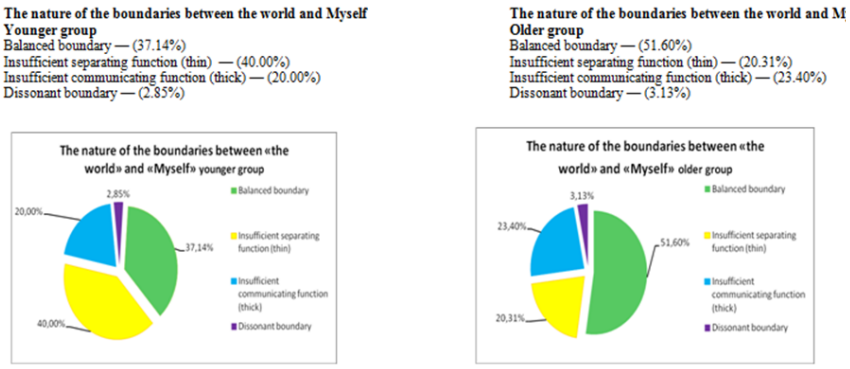

Figure 2 The characteristics of the boundaries between the world and myself in the younger and older groups.

Spearman's statistical analysis revealed that the level of development of a spatial self image is in significant correlation with proportion of the separating and communicating functions of the boundaries (K=0,998**, with p=0,01). A high level of the SSI development is only observed when the two functions of the boundaries are balanced. Children with a decreased or increased permeability of the boundaries in 59% of cases have a medium level and in 37% a low level of the SSI development. Moreover, the medium level predominates in children with thick boundaries and the low level—with thin boundaries. All children with a dissonant type of boundaries development have an extremely low level of the SSI. Consequently, the high level of the SSI generally combines with the balance of the separating and communicating boundaries functions. In order to identify the relationship between the level of development of the spatial self image and the characteristics of the general mental development the same children were examined using the technique of "Diagnosis of mental development of young children".[15] This diagnostics is carried out in three main domains:

1. Communication and speech
2. Substantive activity

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3. Playing

The results of the statistical analysis showed that there is a direct bilateral correlation between the level of the SSI development and the level of mental development both as a whole and by separate characteristics. Pearson's correlation coefficient is: r = 0,793 (with p<0,01). The highest correlation is observed between the characteristics of communication/speech and the sense of self-motion (r=0,803 at the level of significance p<0,01), as well as communication/speech and the sense of touch (r=0,719 with p<0,01). The least correlation was found between the level of development of procedural games and the level of development of the sense of touch, nevertheless, this indicator is also at the level of highly significant correlation coefficient (r=0,585 with p<0,01). The efficiency of substantive activity has a strong connection with the success of imitation (r=0,733) and operational agility (r=0,688 at p<0,01). Overall substantive activity level of development, which is a measure of cognitive activity of younger children, correlates with the level of development of the spatial self image at a high level of significance (r=0,811, at the significance level of p < 0,01). Another crucial issue is the revealed link between general mental development and the nature of bodily boundaries. Analysis of the data proved that among children with extreme characteristics of boundaries functions (both communicating and separating) there are practically no children with a high and medium level of mental development. Therefore, we can assert that formation of a spatial self image at an early age is closely connected to the level of mental development. This connection is of bilateral nature, at the same time, it does not seem possible to establish a cause-and-effect relationship between the spheres based on the research, although we can assume that basic bodily senses and the spatial self image they form are a foundation of the initial form of self-awareness and the foundation of children's general mental development.

Conclusion

In this paper we attempt to examine the age characteristics and individual variations of a spatial self image of children aged 1.6 to 4 years. This integrative formation is based on three basic bodily senses which act as its structural components: the sense of touch defines boundaries, the sense of self-motion provides a feeling of own activity, the sense of balance ensures centricity, wholeness and stability of the bodily self. An important characteristic of a spatial self image is the quality of the bodily boundaries which can have various levels of thickness and permeability. Variations of development of the spatial self image are largely determined by the proportion of the communicating and the separating functions of bodily boundaries. A weakened separating function is expressed in hypertrophic sensitivity and in avoiding of contacts with the outer world; a weakened communicating function is expressed in reduced sensitivity to own experience and external impact. A high level of development of the spatial self image is only possible when the communicating and the separating functions of the bodily self-boundaries are balanced and sufficiently expressed. Moreover, as it appears from the observations, the nature of the boundaries is not only reflected in the sphere of tactile perception, but also in other areas of observation, becoming a generalized characteristic of the child's interaction with the world. The obtained results show that the level of development of the spatial self image at an early age correlates with basic characteristics of children's mental development (substantive activity, cognitive activity, communication and speech). The identified variations of development of the spatial self image are not exhaustive, they are not always of pathological nature and, as a rule, and they are not connected with serious deviations. At the same time, minor deviations in self-perception in early childhood are fraught with further development distortion (1, 3, 8 and others). All this raises the problem of timely development and correction of disorders in the SSI development, which is of paramount importance for further development of children's personality and self-awareness.[16–18]

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Conflict of interest

The author declares that there is no conflict of interest.

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