

## Formation of a Spatial Self-Image at an Early Age

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### ABSTRACT

**Background.** This article reviews the basic form of bodily-physical self-awareness, in particular, a spatial self-image and its most important feature, the nature of boundaries between the “I” and “the world.” The sources of a spatial self-image are: the sense of touch as the experience of oneself within body boundaries; the sense of self-movement or kinesthetic sense; and the sense of balance. All of which together define the quality of bodily self-awareness and mediate the relationship of the child with the world. The basic bodily senses are experienced in interaction, complementarity, and mutual influence, and the resulting spatial self-image is interpreted as the highest mental function. The phenomenon of bodily boundaries is regarded as a key feature of self-perception, and as the premise and trait of interaction with one’s surroundings at early and preschool age.

**Objective.** The aim of the research was to develop and test the diagnostics of spatial self-image, as well as to identify the connection between the level and qualitative features of spatial self-image, and the level and qualitative characteristics of general mental development. A key feature of our experimental method was the fact that the diagnostics situations should be natural and not prescriptive, and the diagnosis itself be compact and held in a form of play. In particular, we used rhythmic tactile-motor games based on thorough psychological analysis as the means of diagnosis.

**Design.** The following components were investigated: the sense of touch; the sense of self-movement; the sense of balance; and, as a qualitative indicator, the nature of the border between the “I” and “the world.” To assess the level of development, seven diagnostic situations were developed (in a microgroup and individually). Carefully using observation, we developed a scale of measurement for each age group, and a qualitative assessment. The study involved 119 children from the ages of 1.6 to 3.6 years old, divided into two groups (1.6 to 2.5 and 2.6 to 3.6) (Moscow, Russia).

**Results.** The study enabled us to describe the characteristic features of various levels of formation of a child’s spatial self-image. We identified the most common tendencies in the formation of boundaries between the “I” and “world, and described their qualitative characteristics, such as the balance between the connecting and dividing functions, and the problems in the child’s difficulty to form the connecting function and the dividing function, as well as the so-called dissonant nature of boundaries. We explained the relationship between the perception of the body’s surface and a most essential indicator of development, the relationships between the Ego and the social and objective world.

**Conclusion.** The research revealed a relationship between the level of spatial self-image development and the level of children's psychological development, both in general and on specific indicators. We showed that one's spatial image is not innate, but a developing neoformation during life; it reflects the development of corporeality as a tool for manifesting individuality and has different options for development.

**Keywords:** Self-awareness; spatial self-image (SSI); sensori-motor development; bodily senses; body boundaries; sensory-motion games; tactile contact

#### Highlights:

- The spatial self-image is formed by integrating three basic bodily senses which act as its structural components: 1) the sense of touch defining perception of oneself within the boundaries of the body; 2) the sense of self movement providing a perception of one's own activity; and 3) a sense of balance ensuring centricity, wholeness, and stability of the bodily self.
- One important characteristic of a spatial self-image is the quality of the bodily boundaries, which can have various levels of thickness and permeability. Variations in the development of spatial self-image are largely determined by the proportion of the communicative and the separating functions of bodily boundaries.
- A weakened separating function is expressed in hypertrophic sensitivity and the avoidance of contact with the outside world; a weakened connective function is expressed in reduced sensitivity to one's own experience and external impact.
- A high level of development of spatial self image is only possible when the communicative and the separating functions of one's bodily self-boundaries are balanced and sufficiently expressed.
- 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 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), which indicates its high importance and the possibility of using diagnostics to support and correct the development of children at an early age.

#### АННОТАЦИЯ

**Актуальность.** В статье рассматривается основная форма телесно-физического самосознания, а именно, пространственный образ себя и его важнейшая особенность — характер границ между “я” и “миром”. Источниками пространственного образа себя являются: чувство осязания как ощущение себя в пределах границ тела; чувство собственного движения (кинестетическое чувство) как восприятие себя в различных качествах движения и покоя; и чувство равновесия как переживание центра в себе и положения тела относительно опоры. Все это вместе определяет качество телесного самосознания и опосредует взаимоотношения ребенка с миром. Базовые телесные чувства переживаются во взаимодействии, взаимодополняемости и взаимном влиянии, а возникающий в результате пространственный образ себя интерпретируется нами как высшая психическая функция. Феномен телесных границ рассматривается как ключевая особенность самовосприятия, а также как предпосылка и характерная черта взаимодействия со своим окружением в раннем и дошкольном возрасте.

**Цель.** Целью данного исследования была разработка и апробация диагностики пространственного образа себя, а также выявление связи между уровнем и качественными особенностями пространственного образа себя и уровнем и качественными характеристиками общего психического развития. Мы предоставляем обзор диагностики пространственного образа себя. Ключевой ее особенностью является то, что диагностические ситуации должны быть естественными, а не предписываемыми, а сама диагностика должна компактна и проходить в форме

игры. В частности, в качестве средства диагностики мы использовали ритмические тактильно-двигательные игры, основанные на нашем тщательном психологическом анализе.

**Дизайн.** Были исследованы следующие компоненты: чувство осязания; чувство собственного движения; чувство равновесия; а как качественный показатель — характер границы между «я» и «миром». Для оценки уровня развития было разработано семь диагностических ситуаций. Используя тщательные наблюдения, мы разработали шкалу анализа для каждой возрастной группы, а также качественную оценку. В исследовании приняли участие 119 детей в возрасте от 1,6 до 3,6 лет, разделенных на две группы (1,6–2,5 и 2,6–3,6) (Москва, Россия).

**Результаты.** Проведенное исследование позволило нам описать характерные особенности различных уровней формирования пространственного образа себя у ребенка. Мы выявили наиболее распространенные тенденции в формировании границ между «Я» и «миром» и описали их качественные особенности. Были выделены следующие варианты: баланс между связующей и разделительной функциями; недостаточность формирования связующей функции границ, недостаточность разделительной функции, а также так называемые диссонансные границы. Мы показали взаимосвязь между восприятием себя в границах тела и наиболее важным показателем развития — отношениями между «Я» и «миром социальным и предметным».

**Выводы.** В ходе исследования была выявлена взаимосвязь между уровнем развития пространственного самосознания и уровнем психического развития детей, как в целом, так и по конкретным показателям. Мы показали, что внутреннее образование — пространственный образ себя — не является врожденным, а развивается в течение жизни; он отражает развитие телесности как инструмента проявления индивидуальности и имеет различные варианты развития.

**Ключевые слова:** Пространственный образ себя (ПрОС); сенсомоторное развитие; телесные чувства; границы тела; сенсорно-двигательные игры; тактильный контакт

**Ключевые положения:**

- Пространственный образ себя формируется путем интеграции трех базовых телесных чувств, которые взаимодействуют как его структурные компоненты: 1) чувство осязания, определяющее восприятие себя в границах тела; 2) чувство собственного движения, обеспечивающее восприятие собственной деятельности, активности; и 3) чувство равновесия, обеспечивающее центрированность, центрированность и стабильность телесного «я».
- Одной из важных характеристик пространственного образа себя является качество телесных границ, которые могут иметь различные уровни плотности и проницаемости. Вариации в развитии пространственного образа себя во многом определяются соотношением соединительной и разделительной функций телесных границ и их достаточной выраженностью.
- Ослабленная разделительная функция выражается в гиперчувствительности к соприкосновениям вплоть до избегания контакта с окружающим миром. Ослабленность соединительной функции выражается в сниженной чувствительности к собственному опыту и к внешнему воздействию.
- Высокий уровень развития пространственного образа «я» возможен только тогда, когда соединительная и разделительная функции телесных границ «Я» сбалансированы и достаточно выражены.
- Характер границ «Я» и «мир» не только отражается в сфере тактильного восприятия, но и в других наблюдаемых сферах развития, становясь обобщенной характеристикой взаимодействия ребенка с миром.
- Уровень развития пространственного образа себя в раннем возрасте коррелирует с основными характеристиками психического развития детей (предметная деятельность, познавательная деятельность, общение и речь), что говорит о его высокой значимости и о возможности использования диагностики для поддержки и коррекции развития детей в раннем возрасте.

## RESUMEN

**Introducción.** Este artículo revisa la forma básica de autoconciencia física, en particular, la autoimagen espacial y su característica más importante, la naturaleza de los límites entre el “yo” y el “mundo”. Las fuentes de autoimagen espacial son: el sentido del tacto como la experiencia de uno mismo dentro de los límites del cuerpo; el sentido de auto-movimiento o sentido cinestésico; y el sentido del equilibrio. Todos ellos definen juntamente la cualidad de la autoconciencia corporal y median la relación del niño con el mundo. Los sentidos corporales básicos se experimentan en interacción, complementariedad e influencia mutua, y la autoimagen espacial resultante se interpreta a través de la función mental superior. El fenómeno de los límites corporales se considera una característica clave de la autopercepción y la premisa y el rasgo de la interacción con el entorno de uno en la edad temprana y preescolar.

**Objetivo.** Nos propusimos proporcionar una visión general del diagnóstico de la autoimagen espacial utilizando un método experimental. Una característica clave fue el hecho de que las situaciones de diagnóstico deben ser naturales y no prescriptivas, y el diagnóstico en sí debe ser compacto y tener forma de juego. En particular, utilizamos juegos rítmicos táctiles y motores basados en un análisis psicológico exhaustivo como medio de diagnóstico. El objetivo de la investigación fue desarrollar y probar el diagnóstico de la autoimagen espacial, así como identificar la conexión entre el nivel y las características cualitativas de la autoimagen espacial, y el nivel y las características cualitativas del desarrollo mental general.

**Diseño.** Se investigaron los siguientes componentes: el sentido del tacto; el sentido de auto-movimiento; el sentido del equilibrio; y, como indicador cualitativo, la naturaleza de la frontera entre el “yo” y el “mundo”. Para evaluar el nivel de desarrollo se desarrollaron siete situaciones diagnósticas. Utilizando cuidadosamente la observación, desarrollamos una escala de medición para cada grupo de edad y una evaluación cualitativa. En el estudio participaron 119 niños de entre 1.6 y 3.6 años, divididos en dos grupos (de 1.6 a 2.5, y de 2.6 a 3.6) (Moscú).

**Resultados.** Los resultados nos permitieron describir los rasgos característicos de varios niveles de formación de la autoimagen espacial de un niño. Identificamos las tendencias más comunes en la formación de fronteras entre el yo y el mundo, y describimos sus características cualitativas, como el equilibrio entre las funciones conectoras y divisorias; la falta de formación de la función de conexión de los límites; y la falta de formación de la función divisoria, así como los llamados límites disonantes. Mostramos la relación entre la percepción de uno mismo dentro de los límites del cuerpo y el indicador más importante del desarrollo de la relación entre el Yo y el mundo (social y material).

**Conclusión.** La investigación reveló una relación entre el nivel de desarrollo de la autoimagen espacial y el nivel de desarrollo psicológico de los niños, tanto en general como en indicadores específicos. Esto explica la relación entre la percepción de la superficie del cuerpo y un indicador más esencial del desarrollo, la línea entre «el mundo» y «yo». Demostramos que la imagen espacial de uno no es innata, sino una neoplasia en desarrollo durante la vida; refleja el desarrollo de la corporeidad como herramienta para manifestar la individualidad y tiene distintas opciones de desarrollo.

**Palabras clave:** Autoimagen espacial (SSI); desarrollo sensorio-motor; sentidos corporales; límites corporales; juegos de movimiento sensorial; contacto táctil

### Destacados:

- La autoimagen espacial se forma integrando tres sentidos corporales básicos que actúan como sus componentes estructurales: 1) el sentido del tacto que define la percepción de uno mismo dentro de los límites del cuerpo; 2) la sensación de auto movimiento que proporciona una persecución de la propia actividad; y 3) el sentido de equilibrio que asegura la centralidad, integridad y estabilidad del yo corporal.
- Una característica importante de autoimagen espacial es la calidad de los límites corporales, que pueden tener varios niveles de espesor y permeabilidad. Las variaciones en el desarrollo de autoimagen espacial están determinadas en gran medida por la proporción de las funciones comunicativas y separación de los límites corporales.

- Una función de separación debilitada se expresa en la sensibilidad hipertrófica y la evitación del contacto con el mundo exterior; una función conectiva debilitada se expresa en una sensibilidad reducida a la propia experiencia y al impacto externo.
- Un alto nivel de desarrollo de autoimagen espacial solo es posible cuando las funciones comunicativas y de separación de los límites corporales de uno mismo están equilibradas y suficientemente expresadas.
- La naturaleza de los límites no solo se refleja en la esfera de la percepción táctil, sino también en otras áreas de observación, convirtiéndose en una característica generalizada de la interacción del niño con el mundo.
- El nivel de desarrollo de la autoimagen espacial a una edad temprana está asociada con las características básicas del desarrollo mental de los niños (actividad sustantiva, actividad cognitiva, comunicación y el habla).

## RESUME

**Origines.** Cet article observe la forme de base de la conscience de soi corporelle-physique, en particulier, une image de soi spatiale et sa caractéristique la plus importante, la nature des frontières entre le « moi » et « le monde ». Les sources d'une image spatiale de soi sont : le sens du toucher en tant qu'expérience de soi à l'intérieur des limites du corps ; le sens de l'automouvement ou sens kinesthésique ; et le sens de l'équilibre. Tous ensemble définissent la qualité de la conscience de soi corporelle et médiatisent la relation de l'enfant avec le monde. Les sens corporels de base sont expérimentés dans l'interaction, la complémentarité et l'influence mutuelle, et l'image de soi spatiale qui en résulte est interprétée comme la fonction mentale la plus élevée. Le phénomène des limites corporelles est considéré comme une caractéristique clé de la perception de soi, et comme la prémisse et le trait de l'interaction avec son environnement à un âge précoce et préscolaire.

**Objectif.** L'objectif de la recherche était de développer et de tester les diagnostics de l'image de soi spatiale, ainsi que d'identifier le lien entre le niveau et les caractéristiques qualitatives de l'image de soi spatiale, et le niveau et les caractéristiques qualitatives du développement mental général. Une caractéristique clé de la méthode expérimentale était le fait que les situations de diagnostic devaient être naturelles et non prescriptives, et que le diagnostic lui-même devait être compact et tenu sous la forme d'une pièce de théâtre. En particulier, nous avons utilisé des jeux tactiles-moteurs rythmiques basés sur une analyse psychologique approfondie comme moyen de diagnostic.

**Conception.** Les composantes suivantes ont été étudiées : le sens du toucher ; le sens de l'automouvement ; le sens de l'équilibre ; et, comme indicateur qualitatif, la nature de la frontière entre le « moi » et « le monde ». Pour évaluer le niveau de développement, sept situations diagnostiques ont été élaborées (en microgroupe et individuellement). Par l'observation minutieuse, nous avons élaboré une échelle de mesure pour chaque tranche d'âge et une évaluation qualitative.

L'étude a porté sur 119 enfants âgés de 1,6 à 3,6 ans, divisés en deux groupes (1,6 à 2,5 et 2,6 à 3,6). (Moscou)

**Résultats.** L'étude nous a permis de décrire les traits caractéristiques des différents niveaux de formation de l'image de soi spatiale d'un enfant. Nous avons identifié les tendances les plus courantes dans la formation de frontières entre le « moi » et le « monde », et décrit leurs caractéristiques qualitatives, telles que l'équilibre entre les fonctions de connexion et de division, et les problèmes de difficulté à former la fonction de connexion et la fonction de division, ainsi que la nature dissonante des frontières. Nous avons expliqué la relation entre la perception de la surface du corps et un indicateur essentiel du développement, la connexion le lien entre le « Moi » et le « monde » (sociale et des objets).

**Conclusion.** La recherche a révélé une relation entre le niveau de développement spatial de l'image de soi et le niveau de développement psychologique des enfants, à la fois en général et sur des indicateurs spécifiques. Nous avons montré que l'image spatiale d'une personne n'est pas innée, mais une nouvelle formation en développement au cours de la

vie ; il reflète le développement de la corporéité en tant qu'outil pour manifester l'individualité et a différentes options de développement.

**Mots-clés:** Image spatiale de soi (SSI); développement sensori-moteur; sens corporels; limites du corps; jeux de mouvement tactiles; contact tactile

**Points principaux:**

- L'image spatiale de soi est formée en intégrant trois sens corporels de base qui agissent comme ses composants structurels : 1) le sens du toucher définissant la perception de soi à l'intérieur des limites du corps ; 2) le sens de l'automouvement fournissant une perception de sa propre activité ; et 3) un sens de l'équilibre assurant le centrage, la plénitude et la stabilité du moi corporel.
- Une caractéristique importante d'une image spatiale de soi est la qualité des limites corporelles, qui peuvent avoir divers niveaux d'épaisseur et de perméabilité. Les variations dans le développement de l'image spatiale de soi sont largement déterminées par la proportion des fonctions communicatives et séparatrices des frontières corporelles.
- Une fonction séparatrice affaiblie se traduit par une sensibilité hypertrophique et l'évitement du contact avec le monde extérieur ; une fonction conjonctive affaiblie s'exprime par une sensibilité réduite à sa propre expérience et à l'impact externe.
- Un niveau élevé de développement de l'image spatiale de soi n'est possible que lorsque les fonctions communicatives et séparatrices de ses limites corporelles sont équilibrées et suffisamment exprimées.
- La nature des frontières ne se reflète pas seulement dans la sphère de la perception tactile, mais aussi dans d'autres domaines d'observation, devenant une caractéristique généralisée de l'interaction de l'enfant avec le monde.
- Le niveau de développement de l'image spatiale de soi à un jeune âge est en corrélation avec les caractéristiques de base du développement mental des enfants (activité de fond, activité cognitive, communication et parole), cela qui indique sa grande pertinence et la possibilité de l'utiliser pour le soutien et la correction du développement des enfants dès leur plus jeune âge.

## Introduction

At present, increasingly more children have certain developmental disorders. Such phenomena as disinhibition, attention deficit disorder, and delays in speech, motor, emotional and volitional development occur at an early age far more often than 20 years ago. According to neurologists and neuropsychologists (Semenovich, 2015), deviant development (without clinical pattern) is observed in 70–85% of children during the first seven years of life. (Boyarintseva, 2019, s. 13)

It has been noted that various types of deviant development in children are apparent 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, and formation of self-boundaries. A child who has a poor sense of his or her body does not control his/her 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 difficulties in school are related to problems with a comprehensive and differentiated perception of physicality, which serves the starting point of all space-subject manipulations (Auer, 2007; Ayres, 1984; 1972b; 2009; Brinkmann, Bonfeld, & Ocheret, 2019; Semenovich, 2015). This is reflected in an un-



formed body schema or image, and, in particular, problems with basic bodily senses (*i.e.*, the 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.

### ***The Concept of a “Spatial Self-image”***

We defined a **spatial self-image** as the feeling of oneself in the boundaries of one’s body vis-à-vis the external environment, including the perception of one’s physical boundaries, one’s own activity, and one’s integrity.

Spatial self-image is not an innate function; it arises in the course of the 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 the environment and developing their own sense of bodily self, increasingly more actively and independently.

The model for a spatial self-image starts during 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 and pull them into their mouths as an external object. When a baby develops hand movements and starts managing its limbs more consciously, the hands cease to be external objects. Interestingly enough, during the next six months, the hands are adopted, and the legs remain an external object; the baby is now trying to grab them, examine them, and take 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 external objects. Thus, we can literally observe the process of babies mastering their bodies as a universal means of developing self-realization.

The child’s communication with close adults plays a crucial role in the development of self-awareness. It is not only the emotional contact that an adult establishes with a baby, but also the physical one; in the process of taking care and nurturing, the adult strokes, hugs, and reacts to movements and sounds made by the baby, thus allowing the baby to feel his body and 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 motion allows the child to increase and to diversify his/her practical contact with the outside world. This contact has two directions: outwards (getting acquainted with the outer world) and inwards (mastering one’s 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 of 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 ***separating yourself from the outside world, through developing boundaries between “Me” and “not me,” “I” and “the world.”*** It is not having an idea of one’s appearance; it is feeling one’s body “from within,” which is essential for having a sense of an integral and separate “Self” (Auer, 2007; Koenig,

2002; Smirnova & Abdulaeva, 2009; Steiner, 2009). Research on 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” (Allport, 2002, p. 245).

The starting point for our work was the concept that a spatial image includes three components: 1) perception of the boundaries of the body; 2) experiencing one’s activity; and 3) feeling one’s integrity, or stability in space. Therefore, we assumed that a spatial self- image develops based on three basic bodily senses: a sense of touch; a sense of one’s own motion; and a sense of balance. The inner perception of oneself cannot be divided into separate parts; it is an integrative function. (Merlou-Ponty, 1999)

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” (Ayres, Koenig, 2002; Smirnova & Abdulaeva, 2015). This sphere is closely connected to the emotional sphere and a sense of security, with the development of affection and trust between a child and an adult, allowing the child to develop a sense of self-identity, the physical boundaries of the 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 world, sensitivity, and susceptibility to external influence (the separative and connective, communicative functions).

Traditionally, the sense of touch is regarded as a means of knowing — a manual, haptic perception. However, the above-mentioned phenomena, together with the research data (Auer, 2007; Ayers, 1972b; Tsakiris, M., 2010), give us the grounds to speak about a 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, or kinesthetic sense**, allows one to perceive oneself as a source of motion and to manage one’s activity freely. Perceiving one’s personal actions is an essential condition of the action itself and the source of the sense of one’s own activity. The main forms of expressing one’s activity at an early age are motion and substantive actions.

In the case of insufficient motion capabilities, or their limitations (including by athetosis, cerebral palsy, paresis or ADHD), a serious deprivation develops (Koenig, 2002; Luria, 2006; Mastjukova, 1992).

**The sense of balance** reflects the perception of the whole body’s position in three-dimensional space. The sense of balance gives the feeling of stability and wholeness to the self. It is activated with every change in position of body parts, such as rotation, or 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 (Ayres, 1984; Vetter et. al., 2008).

These bodily senses have repeatedly been the subject of study in Russian psychopathology and neuropsychology, but have been considered separately, and mainly in relation to pathological states. In this paper, we regarded them as structural compo-



nents of a holistic self-image developed in early ontogeny. Each bodily sense plays its role in the development and functioning of a spatial self-image. A spatial self-image in 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 for developing a SSI occurs at an early age, from one to four years old, when a child is increasingly more active and independent in mastering his surroundings and his own physical capabilities. This process does not always go successfully. Due to the extremely limited sensorimotor experience of modern children (due to congenital immaturity of the central nervous system, low mobility, prevalence of gadgets, etc.), many of them demonstrate dysfunction of basic bodily senses formation and of a spatial self-image which affect their future development.

In this regard, it is vital to detect and correct such deviations in a timely fashion. In order to do so, a skilled technique for diagnosing a spatial self-image at the stage of its development must be created.

### ***Method of Diagnosing a Spatial Self image in an Early and Preschool age***

The main subject of SSI diagnostics is the bodily senses. When developing our diagnostics, we sought to create situations for young children in which their bodily senses would most naturally reveal themselves (Smirnova, & Abdulaeva, 2014).

*The sense of touch* appears most clearly during *manual inspection*: it is the hand that is the leading organ of this tactile perception. Along with this, we have identified a *general bodily sense of touch* which is manifested in feeling a tactile impression all over the body.

We evaluated *the manual sense of touch* using the “Wonderful bag,” where children touched unseen objects of round shapes contained in a bag and recognized a smooth ball, a soft tangle, barbed rounded pine cone, and others among them. The *general bodily sense of touch* was diagnosed using the game “Dough,” which was 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, since it required the child’s trust in the adult and the situation.

*The sense of self-movement* is the second indicator of a spatial self-image. We identified three key spheres where the sense of self-motion manifested itself: 1) *general motor agility and fitting into space*; 2) *willingness and ability to imitate*; and 3) *operational agility while working with tools*.

*Motor agility* was evaluated in a situation of “Free movement in a three-dimensional space,” where the children were invited to move in a circle using a certain organization of space created with subject modules (slide-hole-bumps-bridge). The children walked and ran freely in “Circular musical-rhythmic games” at their own pace, and had to fit into spaces among people, not objects.

A child’s *willingness and ability to imitate* revealed itself in musical-rhythmic gesture-movement games where the adult leader would sing or recite poetry, acting out the meaning of a certain scene with typical expressive gestures, and the children

would reproduce his gestures in turn (while sitting or moving in circle). The sense of self-movement was directly linked to imitation, through which interiorization occurs, *i.e.*, appropriation of the observed actions and understanding of their meaning, while reproducing them all the more consciously. The willingness and ability to imitate an adult in mastering a new action was also revealed in the “Dynamic toy” test.

*Operational agility* manifested itself during the “Bowl-spoon” test. This test consisted of the 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 the child’s understanding of the effect of tools’ actions, by setting the toy in motion (swinging ball-suspension in “pecking chickens”, counter movement of the planks at the toy “blacksmiths”, 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, and centricity while changing one’s position in space.

Two areas of display were identified to test the sense of balance: 1) *active balancing* while independently moving on surfaces of various heights -- where the child enters a situation of possible imbalance (“Steps-bridge” situation); and 2) *reactive balancing* in response loss of balance when rocking, tossing, or tipping backwards in an adult’s lap in the game “Following an even path” (“Swinging” situation).

Two key characteristics were recorded and evaluated for each indicator of spatial self- image:

A *proactive attitude*, which is expressed in an orientation toward certain actions or sensations, and their intensity, energy, and longing for repetitions; and

*Efficiency*, which is expressed in sensitivity to tactile, motor, and vestibular impact, shown in the success rate of the child’s actions in a particular test and their variability and independence.

On the one hand, the aforementioned characteristics are the source of the formation of the bodily senses; on the other, they are a sign of their development.

Proactive attitudes and efficiency were rated on a 4-point scale, where 0 meant totally absent and 3 meant clearly demonstrated. The maximum total figure for all tests could reach 120 points (98 for the younger and 120 for the older group).

The total score for each metric (“sense”) reflected 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 showed the extent to which a spatial self-image (SSI) was developed.

In addition to quantitative characteristics, qualitative ones were also evaluated, such as the nature of the bodily self-boundaries which were defined by the intensity of the separating and communicative function of the boundary.

## Methods

Our diagnostics were carried out in mini-groups (5-8 children) and individually by means of included and non-included observation. This was done in two stages: 1) in group games (sign games and moving around in an organized space) and 2) individually (all the other tests). All the children’s actions were initiated only through

imitating an adult and/or according to the rules of the games; verbal instructions, instructions, and corrections were not applied.

The recording was carried out on two video cameras with subsequent decoding and logging.

To assess general mental development, we used the technique developed by E. Smirnova, L. Galigusova, T. Ermolova, and S. Meschcheryakova (2013). It included: 1) the level of development of communication and speech; 2) object play; and 3) pretend role playing. The rating scale was also from 0 to 3, depending on the nature of certain manifestations and the age of the children.

### ***Participants***

In total, 119 children of ages 1.6 to 3.6 years participated in the diagnostic research. They were divided into two age groups: the younger group (ages 1.6 to 2.5 years) and the older group (ages 2.6 to 3.6 years).

## **Results**

### ***The Level of Development of a Spatial Self-image***

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

***A high level of development*** was observed in cases where the children were proactive, responsive, and quite independent. Such children reacted positively and effectively to various types of impact during the tactile sense tests. They fit in space and subject conditions well during self-motion sense tests, and were willing to be incorporated into situations of imitation. They were calm and open to experience during the balance tests; they balanced their whole bodies in a timely and flexible manner. For toddlers ages 1.6 to 2.5 years, the high level ranged from 84 to 108 points, and for children ages 2.6 years and older, 98 to 120 points.

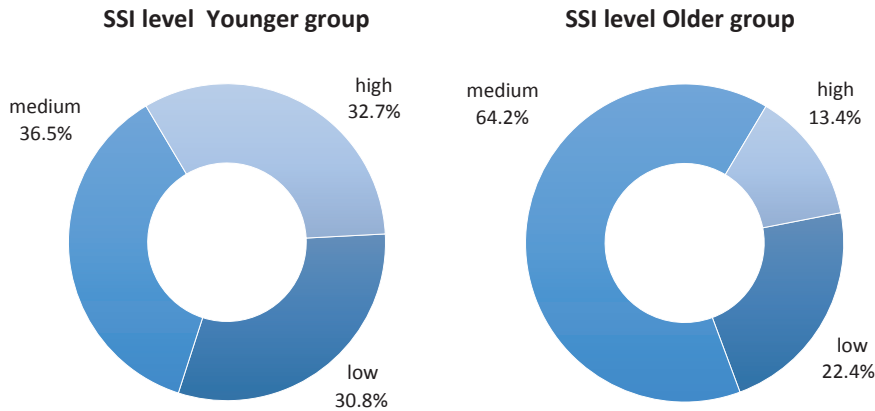
***On a medium level*** of spatial self-awareness, we observed uneven results in different spheres. The existence of proactive attitudes and focus on different experience was unequal. Such children were predominantly active during self-movement sense tests, but might miss some space objects or elements of sign games. They compensated for imbalance inaccurately or with a delay, and needed a safety hand or finger during balance tests. For toddlers ages 1.6 to 2.5 years, the medium level was estimated at 54 to 84 points, for children ages 2.6 years and older, 60 to 97 points.

Children with ***a low level*** demonstrated little focused activity and development of their bodily senses in each sphere of the research. Such children avoided many actions and effects during the sense of touch tests; their motive activity was not related to the task in any way. During self-movement tests, the ability to fit into space showed a dramatic decline; the children did not account for the environment, bumped into objects, and only imitated the adult occasionally and feebly.

During the balance tests such children were highly insecure; they held on to the safety hand tightly. Unpredictability or absence of visual control could reduce their activity to zero. A low level of a spatial self-image development was recorded in cases where the total figure was below 53 points for toddlers and 59 for the older group of children.

Following the diagnostic testing, the results in terms of development of a spatial self-image were as follows: 18.48% of children had a high level; 46.2% a medium; and 35.3% a 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*).



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

*Note.* The diagrams illustrate the change in the relationship between high, medium, and low levels of SSI development from the younger group to the older one.

While the younger group had quite an even distribution, with aging, the proportion of children with a high level dropped almost three-fold; the proportion of children of medium level increased to nearly double, and the proportion of the low level was reduced by only a third.

It is noteworthy that such a paradoxical “development” in modern children occurs in the midst of a sensitive period for the formation of bodily and physical awareness.

### ***The Characteristics of the Boundaries between “I” and “the World”***

As noted above, the qualitative nature of the bodily self-boundaries is determined by the ratio of the separative and connective function of the boundary. The boundary functions reflect the extent of the child’s sensitivity to various stimuli and are determined not only by the sense of touch tests, but also in other diagnostic situations.

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

**Balanced bodily boundaries**, *i.e.*, an equal level of expression of their separative and connective functions. The indicators of activity and efficiency of each of the three bodily senses were more or less equally manifested. Our sample had 47.22% of the

children with balanced boundaries, of which 37.14% were in the younger age group and 51.6% in the older group.

*A weakened separating boundary function, i.e., “thin boundary.”* Children with this type of boundary were characterized by high sensitivity, along with decreased motor and general activity. Such children were extremely cautious and passive; they avoided unexpected experiences. Everything connected with the unknown (*i.e.*, loss of support, absence of visual control) caused insecurity and lowered activity, even leading to refusal. During manual touch sense tests these children were afraid to put their hands inside the bag. During the “Dough” test game, the children avoided direct bodily contact, or only allowed a very mild touch. During balance tests the children were excessively cautious; they tried to avoid situations of imbalance and might react with anxiety and negative emotions to changes in the stability of their support. For some of the children, even slight shaking caused them to grasp, leave, and/or cry. It is noteworthy that the susceptibility in situations of imitation and during operational agility tests proved 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).

*A weakened connective function of the boundaries, i.e., “thick boundary.”* With this type of boundary, a decreased sensitivity was observed, which was sometimes combined with increased activity. In free movement the children could demonstrate high mobility with a lack of motor agility — moving clumsily and awkwardly, and possibly accidentally touching or knocking down elements in space. Their imitative movements were highly inaccurate. Operational skills were low; the children were insensitive to the spatial properties of an object, could not adjust their movements to it, and acted awkwardly and at hazard. They had low sensitivity to changes in their body and support position during balance tests. They regarded their own negative experiences (stumbling, missing) with indifference, and had reduced self-correction of motor inaccuracies. They reacted primarily to intense touch during sense of touch tests, and did not notice those of moderate and mild intensity. Such children comprised 22.65% of the total sample, namely, 20.0% in the younger age group and 23.4% in the older group.

Our research revealed another type of combination of the separative and communicative function of the boundaries, which we called *dissonant*. It was characterized by extreme sensitivity to some stimuli amid ignoring others, or a situational response to the same objects and impact. Thus, for example, while having mastered gross motor skills, such children could have undeveloped focused movements and almost no ability to imitate. Those children were largely those with emotional disorders or with the experience of deprivation. Our sample revealed 4.12% of such children, with one child in the younger group and three children in the older age group. Their diagnosis was of a certain complexity, since they had great difficulty entering into a meaningful dialogue. It is worth mentioning that only intense tactile impact on their whole bodies increased their engagement with an adult.

Below you can see the age dynamics of the boundary characteristics, in a graphic showing the differences between the younger and older age subgroups (*Figure 2*).

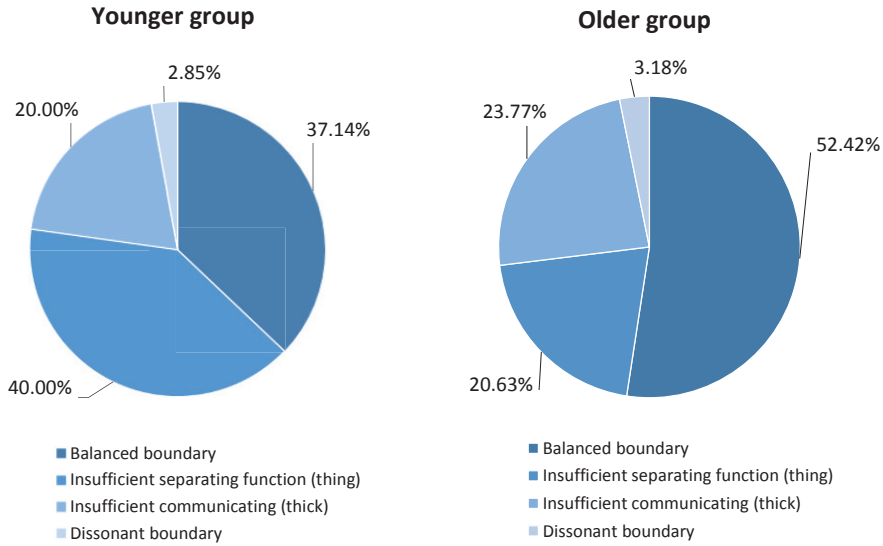


Figure 2. The characteristics of the boundaries between “I” and “the World” in the younger and older groups

Note. The diagrams reflect qualitative changes in the characteristics of boundaries in children of the younger and older age groups.

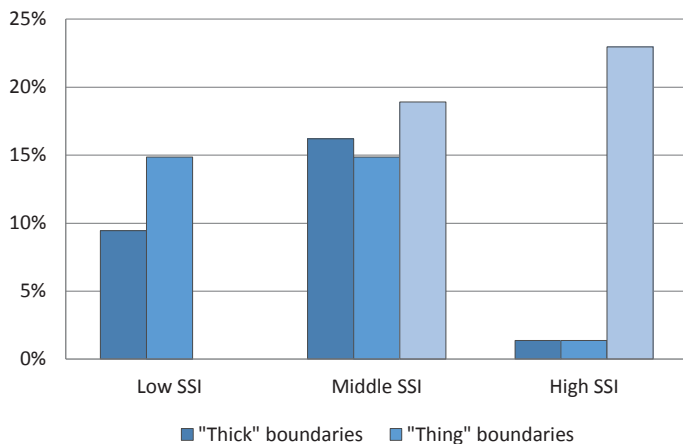
Remarkably, toddlers of the younger age group were more likely to have excessively thin boundaries, while children of the older age group had a tendency to thickened boundaries. It can be assumed that a thin boundary is a condition for high susceptibility to contact with the outside world, including relations with a close adult, and can indicate the specific character of boundaries in ontogenesis.

***The Relationship between the Level of Development of a Spatial Self-image and the Characteristics of the Boundaries between the “I” and “the World”***

Spearman’s statistical analysis revealed that the level of development of a spatial self image was in significant correlation with the proportions of the separative and communicative functions of the boundaries ( $K=0.998$ , with  $p=0.01$ ). A high level of SSI development was only observed when the two functions of the boundaries were balanced. In 59% of the cases, the children with a decreased or increased permeability of the boundaries had a medium level, and in 37% a low level of SSI development. Moreover, the medium level predominated in children with “thick” boundaries, and the low level in those with “thin” boundaries. All children with a dissonant type of boundaries development had an extremely low level of SSI. Consequently, a high level of the SSI generally went along with the balance of the separative and communicative boundaries functions (Figure 3).

In order to identify the relationship between the level of development of spatial self-image and the characteristics of general mental development, the same children





*Figure 3.* The relationships between the level of development of SSI and the nature of boundaries

*Note.* The diagram reflect the connection of the characteristics of boundaries and the level of SSI

were examined using the technique of “Diagnosis of mental development of young children” (9). This diagnostic was carried out in three main domains: 1) communication and speech; 2) substantive activity /object play; and 3) pretend role playing.

The results of the statistical analysis showed that there was a direct bilateral correlation between the level of SSI development and the level of mental development, both as a whole and by separate characteristics. Pearson’s correlation coefficient was:  $r = 0.793$  (with  $p < 0.01$ ).

The highest correlation was observed between the characteristics of communication/speech and the sense of self-movement ( $r = 0.803$  at the level of significance  $p < 0.01$ ), as well between 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 pretend role play and the level of development of the sense of touch. Nevertheless, this indicator also had a highly significant correlation coefficient ( $r = 0.585$  with  $p < 0.01$ ).

The efficiency of a child’s object play had a strong connection with his/her success at imitation ( $r = 0.733$ ) and operational agility ( $r = 0.688$  at  $p < 0.01$ ). The overall level of development of object play, which is a measure of cognitive activity of younger children, correlated 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 was the relationship we found between general mental development and the characteristics of bodily boundaries. Analysis of the data showed that, among children with extreme characteristics of boundaries functions (both connecting and separating), there were practically no children with a high and medium level of mental development.

Therefore, we can assert that the 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 for the initial form of self-awareness and children's general mental development.

## **Discussion**

This research did not investigate the reasons for the worse state of self-image development in children 2.6–3.6 years old compared to children 1.6–2.5 years old. But we believe that there are a number of reasons for this result, ranging from the long-term consequences of prenatal and perinatal features and problems of deficiency of natural sensorimotor experience (including autos and baby stroller) instead of its expansion and differentiation, to the overload of sensory systems with artificial stimuli and early gadgetization, and the deficiency of natural areas for active walks, as well as specific parental attitudes/restrictions.

Within the framework of this study, no observation of children in rural areas was carried out. We believe that their situation may be somewhat better due to the specifics of their living conditions and more democratic parental attitudes.

The correlation at a high level of significance between the level of SSI and general mental development, both in general and in individual indicators, suggests that a system of developmental classes aimed at developing basic bodily feelings and self-perception within the boundaries of "I and the world" can be an effective means of promoting overall child development. (Our further research has fully confirmed this hypothesis).

Differentiation by individual parameters, careful observation and selection, and development of situations suitable for different ages allowed us to give an accurate picture not only of the sample as a whole, but also for each individual child. Thus, this tool can also become the basis for building a program of games and activities depending on the tasks of development of each child and allow you to track the results.

## **Conclusions**

1. A person's spatial self-image as an 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 one's own activity; and the sense of balance ensures centricity, wholeness, and stability of the bodily self.
2. 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 in the development of the spatial self-image are largely determined by the proportions of the communicative and the separative functions of bodily boundaries.
3. A weakened separative function is expressed in hypertrophic sensitivity and in avoiding contacts with the outside world; a weakened connective function is expressed in reduced sensitivity to one's own experience and external impact. A high level of development of spatial self-image is only possible when the communicative

and the separative functions of the bodily self-boundaries are balanced and sufficiently expressed.

4. The nature of the boundaries is not only reflected in the sphere of tactile perception, but also in other areas we observed, becoming a generalized characteristic of the child's interaction with the world.
5. The level of development of spatial self-image at an early age correlates with basic characteristics of children's mental development (substantive activity, cognitive activity, communication, and speech).
6. Our research has shown that our proposed method, thanks to its undirected play and imitation paradigm, is effectively applicable for children from 1.6 years old on.
7. Since the phenomenon of spatial self-image presented here has every reason to influence a number of higher mental functions as a bodily and physical basis for the formation of self-consciousness, the study of its formation and development in early and preschool age deserves expansion and deepening.

### **Limitations**

It is desirable to expand the sample, expand the age range, and also conduct a comparative analysis between children from large cities and rural areas. This will allow a deeper analysis of the formation of the spatial self-image in connection with the general mental development depending on the conditions.

### **Ethics Statement**

Written informed consent to participate in this study was provided by each parent.

### **Authors' contributions**

This research was carried out by E.A. Abdulaeva and presented as a doctoral dissertation. Dr. E.O. Smirnova was a scientific counselor, who actively initiated the discussions, and helped to shorten and simplify the method, in order to present the results compactly and correctly. Dr. E.A. Abdulaeva developed the theoretical and practical basis for the study; she developed the method, scales, and procedure of experimental diagnosis of spatial self-image for children at different ages. She also used the diagnostic system "General mental development of children" developed by Dr. E.O. Smirnova et al. E.A. Abdulaeva conducted all the experiments (with the involvement of a fellow intern), and analyzed and presented the data. The authors jointly discussed the results of the research and collaborated on the manuscript.

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