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CONNECTING PARADIGMS OF MOTOR BEHAVIOUR TO SPORT AND PHYSICAL EDUCATION

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Chapter 4

THEORETICAL IMPORTANCE OF MOTOR SKILLS STUDIES: THREE REFLECTIONS IN ONE MIRROR [3]

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"Thoughts are made from the same matter as things"
W. James (1913)

"Mind and body are not two different things; they are rather two different ways of perception of the same thing"
A. Einstein (1937)

Although motor behaviour studies are recognised as a kind of applied discipline, it has theoretical potential which makes it able to be involved in fundamental psychological research. This paper examines some relations of the motor skills studies and fundamental problems in psychology.

PART I. Theoretical Survey: Three Reflections

State of affairs in contemporary psychology:
Is fundamental psychology possible?

Unlike other natural sciences, such as physics, biology, chemistry and mathematics, which have generally agreed upon fundamental prin-

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ciples, there is no accepted "fundamental psychology" in the world scientific community today. Even the term "theoretical psychology" looks more like an uncertain task for the future than an accurate reflection of the current state of affairs in this science.

The scientific task of creating a "fundamental psychology" in today's scientific environment is formidable, if not nearly impossible. Such a project would likely consist of attempting to combine a wide variety of unclear concepts coming from many different backgrounds, expressed in many different languages, weaved by highly contradictory empirical and experimental data, and decorated by a wide variety of practical applications. Moreover, there is no single "psychology" to work with, but rather, there are a lot of very different "psychologies". Finally, the idea of a "fundamental psychology" is not generally accepted in the scientific community *as a real need, as a basis from* which this science could move to a higher level.

Psychology as a science has found itself in a state of permanent crisis from the time of W. James until now. Any attempt to overcome this crisis by creating a new theory in psychology brings that new theory into a situation where it merely exists side by side with the theories it intends to replace. Extension does not mean development, and fruits are not roots.

On the other hand, the history of science shows that the necessary way out from the perpetual crisis that psychology finds itself in is deeply connected with accomplishing the task of creating a "fundamental psychology." Such a fundamental psychology would not only unify the many sub-disciplines and approaches in psychology into a common science, it would reflect the authentic roots and soil of their subject-matters, and not just collect their flowers and fruits.

However, a "fundamental science" does not appear out of nowhere. Its construction presupposes a certain level of development of the science, which makes it "ready" for the new, revolutionary fundamental generalisations which would bring fresh perspectives of analysis and

methodology to address the general problems of the science.

Psychology is likely to pass through the similar stages of development as have other sciences, from the domination of "umbrella-like" theoretical constructions covering specific sets of phenomena, to the appearance of *basic ultimate foundations* constituting the fundamental science as a whole. But how close is psychology, as a science, to making this radical step forward?

A new fundamental stage in a science does not start from simply stating, selecting and interpreting certain fundamental facts in order to bring a universal status to them. On the contrary, it seeks out the fundamental *methodological* problems of the science, brings a new understanding to them, and then uses this new understanding to explain known and familiar empirical facts from a new, radically different perspective, showing the limits of the previous understanding. The new understanding finds and shows new links and new connections between old facts. The science as a whole is transformed.

The appearance of a certain set of methodological problems (we could define it as "the problem field") might serve as a reliable indicator of the state of affairs in a scientific discipline, which might show in what degree the "fundamental science" is needed and possible.

It is apparent that psychology today, as a general scientific discipline, is currently experiencing a complex combination of deep methodological difficulties. Here are four examples of these kinds of problems.

„Internal" and „external". From the time of Aristotle psychology has defined its subject-matter as the "internal world of an individual", as inner mental processes and functions. In R. Descartes, the two realms, mind and body, were viewed as two separate and different worlds, obtaining the status of absolute matter (similar to "absolute space and time" in Newtonian classical physics). The riddle and the most challenging problem of psychology is how the internal becomes external and how the external becomes internal. Nowadays it has be-

come clearer that the distinction between the two is more relative than absolute, and the border between them is looking more and more washed away. The famous concepts of internalization/externalisation seem to be limited and not able to cover the whole process; and especially, they are not able to satisfactorily describe the transformations between the two. This crucial question is arising in such an authoritative manner today that there are fewer and fewer grounds to avoid or to neglect this problem. Are there any reasons remaining not to assert that the mind and body, and by extension, the internal and external, are indeed not absolute, but in many important senses, are relative, as generated dynamical results coming from one and the same root?

Psychology and physiology. There is an obvious gap between psychological and physiological approaches to the development of mind. The human mind can hardly be explained simply by the activities of the morphological brain structures. On the other hand, being ignorant of physiological and neuro-physiological processes (at least as prerequisites of mental world) will hardly lead us to success, either. Despite enormous amounts of work being undertaken today toward bridging this gap, it still exists in a big way. Moreover, this work is constantly obtaining new dimensions - but not yet the right solutions, bringing more questions than answers to the table, almost by the day.

Voluntary – involuntary actions. How are voluntary and involuntary (motor) actions interconnected? "Classical" models and schemes, explaining the process how of voluntary actions arise on the basis of involuntary ones, are no longer valid. From this it follows that the opposite way which represents the motor skills as a kind of automatised actions of higher order, cannot anymore be considered as absolutely undisputable. The problem arises: what is the psychological structure and the nature of the actions we call "skills"? Are they simply auxiliary components of higher forms of activity, or they are independent formations, having their own origins and structure? Where do they originate, and in what form?

Development.. This seems to be the most difficult problem in psychology. "Change" and "growth" are not synonyms to "development". Empirical methods of analysis in psychology are mostly able to *describe in very narrow context* different stages (levels, phases etc.) of the whole process of development. Most of the famous periodisations in developmental psychology (including Piaget, Erikson, and Kohlberg) present development as a series of transitions from one stage to another, so development is described as linear process. On the other hand, it is quite clear that to simply compare *State A* and *State B* of a given system does not mean one has explained the developmental changes that take place between the states. In psychological research today, transitional periods, developmental gaps and acts of development in most cases remain close to empirical-descriptive methods. The process of development itself as qualitative change of the system, and as the reorganization of the given system, still remains mostly unknown for psychology.

These methodological difficulties might be resolved by different means and tools, from different perspectives; that is, these doors might be opened with different keys. I will not try to discuss these possible doors and keys and their validity in this chapter. My task is simpler. In these pages, I only intend to present one possible way to open these doors with one, and the same key.

The paper's subtitle is "three reflections". This means that the paper discusses the possibilities for fundamental psychology created on reflections (philosophy, geometry and psychology) which, in turn, reflect each other, creating a framework of "reflective reflections" as a multidimensional projective space.

First reflection: Philosophical mirror

According to Rene Descartes (1596 – 1650), the two substances (the extended substance and thinking substance) are of different natures and exist in different *spaces* (Descartes, 1997).

From this philosophical origin, scientific psychology adopted as its key subject matter the internal subjective world. Since then, psychology has been confronted with a crucial, fundamental problem to solve – how are these two substances connected, and how do they interact? We could formulate this problem as: how are the subjective motivations of the body movements possible? (How can I move my hand by my thought?)

The "two-substances approach" claims that the "extended substance" and "thinking substance" are of different natures. This means that they exist in different *spaces* and *times*. Thus, "extended" substance presupposes a certain place or area for its extension, the place which is usually defined as an "external world". On the other hand, "thinking" substance presupposes a certain space in which it should *take place*. This kind of space is defined as an "internal world" or "subjective world," the inner world of human mind.

The question arises: What are the origins and the natures of these two spaces? There are two possible answers to this crucial question: (1) these two spaces have different origins and therefore, different natures, or (2) they have one and the same origin and therefore, they have the same nature.

Spinoza (1632-1677) proposed a radical solution to this problem. In his proposal, there are not two substances that mystically interact, but there is in fact only one kind of general substance. Both extension and thinking are attributes of this substance (Spinoza, 2002). The core concept for B. Spinoza is body - the thinking body, which is both extended and thinking. But what is body? Spinoza considered body as the moving body. Therefore, the Spinozian substance is, first and foremost, a moving substance. Movement makes it possible for both extension and thinking to be attributes of substance. In this way, Spinoza's whole approach connects the "external" and "internal" worlds through the movements of the body.

Spinoza's way of approaching the problem shows that the riddle of the "interaction of the substances" might be solved by analysis of the nature of human movements. In this outlook, there is no gap between the two: "external space" and "internal space" are spaces which are intimately connected to each other IN movement and THROUGH movement. In this way, the question of how can two fundamentally different kinds of substances with fundamentally different natures that are moreover located in different spaces actually interact ... is transformed into the question of how is the thinking body connected to its surrounding world through movement.

Second reflection: Mirror of geometry

For many centuries, the idea of a three-dimensional world has been treated as basic for the natural sciences. The three-dimensionality of the external world was viewed as a basic axiom, as well as something completely coinciding with common sense and our everyday experiences. From the school years everybody knows the basic model of the geometrical three-dimensional coordinate system. As Euclidean geometry claims, space is pre-existing and bodies are located in this pre-existing space.

Riemann's geometry idea (Riemann, 1953) was to introduce a collection of numbers at every point in space that would describe how much it was bent or curved. Riemann found that in four spatial dimensions, one needs a collection of ten numbers at each point to describe the properties of a manifold, no matter how distorted it is. The key concepts of Riemannian geometry were "higher dimensions", "projective space" and "movement".

According to Riemann, dimensionality (projection) is the fundamental characteristic of space, where (n-) dimensional space is qualitatively different from (n-1) dimensional space and cannot be reduced to it. (The Euclidean analogue is that three-dimensional space is not a

mechanical sum or aggregate of two two-dimensional spaces, i. e. two plane projections do not constitute the three dimensional object, the projections of which they are).

In Riemann's model, space does not pre-exist. It is not an "empty place" in which bodies are located. Space is, rather, a dynamical process, created by moving bodies; it is the dimensional result of bodies in motion. Movements create spaces of higher dimensions, which are qualitatively different from the spaces of lower dimensions.

Reflective reflection: Focus on psychology

Despite revolutionary changes in philosophy and geometry in approaching the old problem of "two substances", psychology has yet to challenge this classical foundation and initial assumption. The basic Cartesian formula "stimulus" – "response" (S - R), which is not able to bring any satisfactory answer to this matter, still dominates most types of theoretical discourse in psychology and remains undisputable and indubitable. The history of psychology demonstrates many attempts to overcome this basic contradiction, mostly by modifying it by different ways, but no attempts have been successful. Even radical social constructivism does not bring any new challenge to this fundamental principle.

The psychology of motor acts remains on the periphery of psychological research. It is considered as a sort of applied discipline dealing mostly with sports and physical training, having no essential importance for fundamental psychological theory. A similar situation existed with the study of the physics of elementary particles in the times of Earnest Rutherford at the beginning of the 20th century. The physics of elementary particles was seen as something located somewhere on the margins of the theoretical mainstream. But very soon, quantum mechanics brought revolutionary changes to general physics, introducing completely new solutions for problems, and proposing radi-

cally new foundations for the whole science. Let us have a look at the history of motor behaviour studies from this point of view, in order to detect to what degree this "applied discipline" is able to reformulate the fundamental principles of contemporary psychology.

Motor behaviour studies: Possibilities of non-classical approach

Chelpanov (1862 - 1936) investigated the problem of the perception of space in humans. Experimental studies demonstrated that the perception of space is not the result of generalised perceptions of discrete objects or processes, existing and localised in outside physical space (Chelpanov, 1896, 1904). On the contrary, the perception of space becomes possible as the result of *movements* of the body. Humans are unable to perceive "outer" space without their own movements within the space. Later, in the mid-1970s, A. Mirakian in *Contours of transcendental psychology* (1999), based on a substantial amount of experimental data, demonstrated that human perception as a mental process cannot be identified simply as pure reflection. On the contrary, perception is creative process.

On the basis of Chelpanov's work, the first conclusion could be formulated "Space is intimately connected with movement". What is the nature of this connection?

Russian scholar Nikolai Bernstein proposed the theory of coordination and regulation of live movements. In reflex theory, everything that happens has a cause in the past, and this completely explains motor activity. The Bernstein-inspired approach proposes that the human or animal has a model of the desired future according to which the actions are taken. The motion (movement) phenomena are aimed at solving a certain problem based on a model of the future; they deal with certain motor task. The most intriguing idea of Bernstein was that on each level, the movement does not only change or overcome the existing space, but rather *it creates the space of its own.* (Bernstein, 1967)

Bernstein's studies improve the first conclusion and tie in the work of Mirakian. It can now be reformulated in the following second conclusion: "The nature of the connection between movement and space is that movement creates space".

Zaporosets has also done research on visual perception and movements. His experimental studies have shown that at a certain point of its development (infoldment), perceptual movement differentiates into two components – productive and re-productive ones (defined in classical tradition as motor skills). (Zaporosets, 1986) Such differentiation is a basic characteristic of perceptual movement. From the second conclusion and from the results of Zaporozets discovery follows conclusion three: "What we perceive as an "external world" is created by our movements". Reproductive components of movements are "responsible" for the maintenance of the image of the space, whereas productive components are responsible for obtaining the images of the objects, so that they look as if they are located in the external space.

The space we perceive as pre-existing is in actuality created by movement. Movement is the origin of "external space". This leads us to a very important question. What about the "internal world"? Is the internal world just a reflection of the external one (due to internalisation)?

A possible answer could be found in the frames of T. Jarvilehto's conception of "organism-environment" (OE) system. The core concept in T. Jarvilehto's approach is the concept of result: the OE system is an organisation for the result. Looking very closely at N. Bernstein's idea of the motor task, this concept of the result of the OE system, as it is presented in T. Jarvilehto's approach, sheds additional light on this question. OE system theory claims that each "so-called" psychological function is nothing more than a certain aspect of the "organism-environment" system (Jarvilehto, 1998a, 1998b, 1999).

On this basis I propose that OE systems are systems emanating from movement. Therefore, it follows that movement should be the basic unit of the OE system. Movement, in this view, contains all the

qualitative characteristics of the whole system. My hypothesis can be confirmed only if it can be proven that every live movement contains sprouts or shoots of psyche.

The experimental studies of Gordeeva and Zinchenko could possibly supply the confirmation. They claim, at least in a certain sense, that every movement contains all psychological functions (perception, memory, emotions, etc.). "We could say that the movement itself is creating (forming) human psyche" (Gordeeva & Zinchenko, 1982, p.31).

Studies of motor activity and human movements demonstrate, at least to a certain degree, that "external" and "internal" worlds are of the same nature and are from the same origin. Human beings perceive them as different, but they are not essentially different, but *differentiated* by live movements. Therefore, there is no border between them: at least, the borders between the external and internal are very different and far more fluid than have been so far understood by mainstream psychology

PART 2: Consequences: Multidimensional Model of Development

Psychological effect of subjective space

The effect of "psychological space and time" is not new for psychology (see, for example K. Lewin's considerations on this in Lewin, 1936). Traditionally, psychology brings explanation to such a phenomenon by appealing to the mechanisms of sensory perception of space and time. In our experimental work with children of different ages we explored the paradox: The child and adult live and interact while nevertheless existing in *different* spaces and times. For example, physically, for the child, the same room is much bigger than it is for an adult, and one day (or even one hour) for the child is in fact a much longer period of time than it is for an adult. This demonstrates that the child and the

adult apparently exist in different physical spaces and times. H*ow is interaction then possible?*

Of course, in actuality, there is only *one* physical space. What makes it different is the different *perceptions* of the child and adult. The problem is therefore not of different physical spaces, but of different mental (psychological) worlds. But this clarification does not change the problem - rather, it puts it in more exact way. How is interpersonal (inter-mental) interaction possible within (or rather between) different personal, mental spaces? The answer must lie in the process by which these kinds of interactions are mutually built.

Suggestions

As a starting point we propose the dimensional model of development, presented on Figure 1 (Veresov, 2006, Helenius & Veresov, 2005; Veresov & Agafonov, 2004). It is *a dimensional* model since it proceeds not from a linear approach to development; it is based on the multidimensionality of the space-time continuum, which can neither be reduced to the number of dimensions (projections), nor disaggregated from them. This allows us to describe *development as a process of qualitative changes* of a reorganising system.

Some necessary explanations of the dimensional model of development

The model presupposes that the space of interaction in a course of development has six dimensions (it includes time as a dimension)[4]. Child and adult interaction takes place in this six-dimensional space (including physical and mental dimensions). Interacting with the adult, the child builds, prospectively, three-, four-, and five-dimensional spaces.

[4] To simplify the description, the time dimension is omitted from Figure 1.

Every new dimensional space is qualitatively different from the previous spaces, cannot be reduced to them, and cannot be disaggregated into single dimensions.

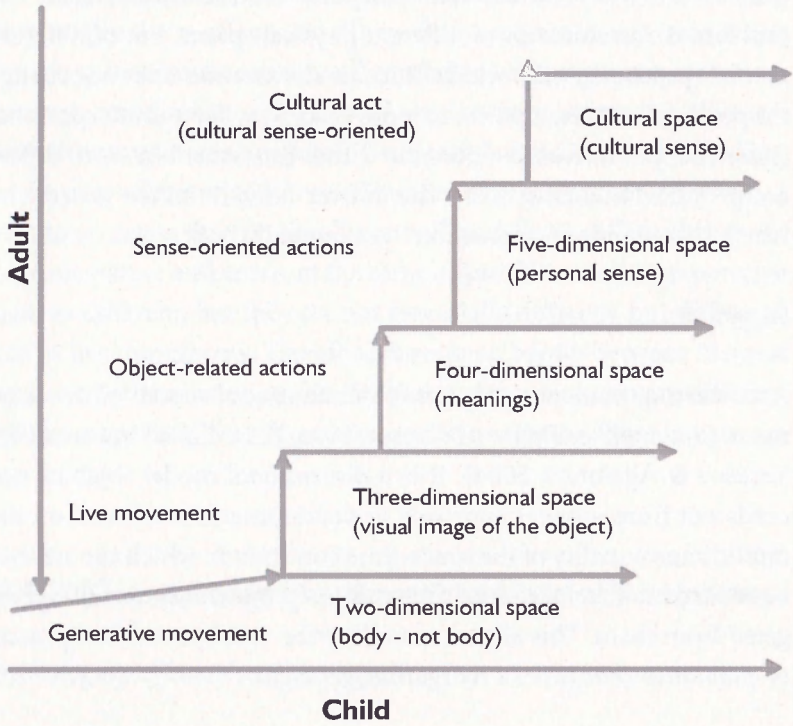

Figure 1. Dimensional model of development

The generation and differentiation of movement, and the spaces these movements in turn create, are the essential traits of the model. Each dimensional space is not simply an existing area or field where movements take place. These dimensional spaces are generated as *a result of movements*. The result makes possible the differentiation of movements into productive and reproductive components and therefore

facilitates the transition to the next level of movements and dimensionality of space. A child's development could be seen as transition from one dimensional space to the next. Development therefore is the creation of a new type of space *by movements* (actions). Dimensional space cannot be identified as external or internal - it is a dynamic structure. "Mental image" is just one of the aspects of this structure. Human mind is not a thing or place - it is a process.

Levels (spaces) of development do not replace each other in a course of time. Each new level (space) includes and builds on the previous one. Each developmental level is characterized by:

- certain types of movement (actions) and
- certain types of dimensional spaces created by these movements

Each higher developmental level of movement requires interaction with the adult (or the other), and originates as such an interaction. Each new type of movement generates (creates) a higher, qualitatively different type of space and therefore, the possibilities for a new, qualitatively different type of movements (actions) within this space. Each developmental level of space is characterized by certain achievements (results) which are conditions for the creation of higher dimensional space. Each higher developmental level reorganizes the lower movements so that they *maintain* lower dimensional space. Within the action of higher level, each action of the lower level changes *and maintains* the space for the action of the higher level.

After obtaining the result (mental image of the space), every movement differentiates into productive and reproductive components. Productive components are "responsible" for the construction of a new dimensional space, whereas reproductive components (motor skills) are "responsible" for maintaining the space, which is simultaneously perceived by an individual as their "surrounding world."

PART 3. Descriptions of the Developmental Spaces

Two-dimensional space and generative movement

Generative movement is movement (bodily, facial, eyes, any kind of motor activity), that generates the image of outside space. This type of movements of a new-born child is familiar to everyone as a type of spontaneous, chaotic movements of child's body (arms, legs). From our point of view, these movements have a deep sense: they are not completely chaotic and spontaneous - they are generative movements, generating and maintaining the image of "outside" space.

The following illustration might be of help. Consider that I am looking on myself to the mirror. What do I see? I see my face reflected in the mirror. I move on the right. Reflection also moves also. It moves the same direction I move. (My shadow does the same).

Let us take a situation of different type. There is an object in front of me. I move my hand on the right of this object. What about the object? Can we suppose that relative to my *moving hand* the object does not move? Not, of course. It "moves" on the left. My hand and the object move. The object does not follow my movement - it moves in the opposite direction. The situation does not change when I move back to the object! So, both my hand and the object are the participants of the movement. We can call this "joint movement". But what is the most important point here is that this movement generates the space - that "classical" outside space we consider as it is given before we started to move. Such movement creates what we can call the *extension* not *in* space and time, but *extension of space and time*. Movement therefore could be defined as a quantum of space. Space is not a pre-existing place or empty room for bodies and movements - space is dynamic structure, created by the movements of the bodies.

Why this stage of development is important?

1. As the result of these generative movements the child begins to separate his body from the external world. The child begins to understand that the external world is not just a continuation of the body.
2. The main achievement (result) of this stage is that the child creates the outside space (two-dimensional space).
3. This achievement (the result) is a condition for the transition to the second level – the level of live/living movement within this two-dimensional space.

Live movements and three-dimensional space

Living movements (Bernstein, 1967), which are different from the level of generative movements discussed above, are movements that are organised in such way that they create three-dimensional space. When this happens, perceptions of external objects (objects separate from the body) become possible. Living movements reorganise the system of generative movements in such way that they now are "responsible" for maintaining the external space - they becomes generative/maintenance movements. They create the conditions for the next stage - the stage where these movements within the three-dimensional space can generate four-dimensional space - meanings.

Object-related actions and four-dimensional space

Object-oriented actions create four-dimensional space, qualitatively different from three-dimensional space.

Object-oriented actions originate as actual "child-adult" interactions, common actions with objects, where *the child is not less active than adult.* Therefore, the four-dimensional space is the space of inter-subjectivity. It is inter-subjective space. So-called mental actions

are not internal - they are just aspects of four-dimensional space. These actions reorganise the lower level (live movements) in such way that they begin to maintain and reproduce the three-dimensional space.

Four-dimensional inter-subjective developmental space produces the necessary conditions for the transition to the next higher level - the level of sense-oriented actions.

Sense-oriented actions and five-dimensional space

This is the level of sense-creating actions. Such actions are not pure imitations, on the contrary - they are creative, productive actions. They produce qualitatively new types of space through the objectification of personal sense. This five-dimensional space is not "external" or "internal" space. It is NOT a virtual or imaginary space - it is a real space which is created by sense-oriented actions.

Sense-oriented actions and five-dimensional space requires child-adult (child-child) inter-subjective interactions. Sense-oriented actions in turn transform object-oriented actions so that they begin to maintain the lower four-dimensional space. This level also creates the prerequisites for the creation of the next and highest level - the six-dimensional level of cultural sense.

Cultural space and sense-based actions

What is cultural sense? Modern philosophical and culturological literature defines cultural sense as a system of moral positions, values and value-directed attitudes presented in cultural phenomena (Bakhtin, 1981, Lotman, 1974). Human culture is a system of human values and value-directed attitudes: cultural sense is a value-based attitude, which takes the form of a cultural/moral norm of behaviour and activity. For example, a fairy-tale exists not only at the level of the plot or script: it

has a deeper level in which a moral norm or attitude is presented. In brief, fairy-tale is objectified cultural sense.

Cultural sense-based actions are mostly looking like independent, undetermined, voluntary (free will, etc.) whereas our model explains that they are determined by the cultural sense. They cannot be explained from the logic of three-dimensional space, from this perspective they look non-logical. They take place in the space which has its own determinants, different from the demands of the "surrounding" situation. Free action is not independent; it exists in cultural space and time.

Conclusions

The crisis in psychology has deep methodological and philosophical roots. Similarly, as it has happened in other sciences (for example, physics, biology, astronomy), the crisis is likely to be overcome by establishing new explanatory principles.

In this respect the studies of motor behaviour, motor activities, and living movements obtain the status of fundamental importance for the future theoretical discourse in psychology, bringing a new way to understand the nature of the relation between the "internal" and "external", "voluntary" and "involuntary", "psychological" and "physiological". The core problem of psychology is that of understanding *development* as a process of qualitative change and the problem of the nature of *movement*. A new theoretical model which can take all this into account and combine the conceptions of development, movement and space in their ultimate unity is a prerequisite for creating a new research methodology.

The model introduced in this Chapter covers not the states, but the *whole process* of mental development as the process of obtaining new qualitative characteristics. It covers the ongoing reorganization of the living system. It corresponds with the main principle of the development of the living systems (organisms) – the *principle of pro-*

gressive differentiation. Human mind, therefore, is viewed as a living system, a sort of organism, not just a mechanism. Therefore, it has no mechanisms in itself, and "mechanical" movements (skills) are folded, transformed organic movements. Motor skills as reproductive components of generating movements are extremely important for mental development since they are components that reproduce an adequate representation of the surrounding world for the individual.

The theoretical model presented here is based on a *non-linear approach to the process of development.* Multidimensional space is not external or external since it is created and maintained by generating movements. The model also explains why an individual perceives the space he creates as if it is an internal and pre-existing world (space). The differentiation of the spaces is the result of the differentiation of the movements of different levels.

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