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Review paper

INTERPRETATION OF BASIC CONCEPTS IN THEORIES OF HUMAN MOTOR ABILITIES

Abstract

The basic *aim* of this research is to point to the possible language, logical and knowledge problems in interpretation and understanding of basic concepts in theories of motor abilities (TMA). Such manner of review is not directed only to „mere understanding", it can lead to a new growth of scientific knowledge. Accordingly, the research question is set, i.e. the research issue*: Is there a language, logical and knowledge agreement between basic concepts in the theories of human motor abilities?* The answer to the set question direct that a more complete agreement between the basic concepts in the theories of human motor abilities should be searched in a scientific dialog between researchers of various beliefs.

Key words: THEORY/ MOTOR ABILITIES / STRENGTH / POWER / SPEED / ENDURANCE / DEXTERITY / COORDINATION / FLEXIBILITY.

INTRODUCTION – THEORETIC BASIS

One of the basic tasks of every science is developing terminological systems as a basic component of scientific communication. Terminology is the specific language of science, and a term or an expression is a word with precisely determined meaning, which can be used in science in *meta* language, just as well as in *object* language. A scientific language, with precisely determined terms, should be clean, accepted by the scientific community; scientific terms ought to mean the same to everyone. Such strictly determined language can often be observed within certain scientific community. Truth be said, a question arises: is it enough to understand scientific facts by the language in which they are expressed? This is not an easy question to answer , but we should bear in mind that the subject of scientific research are not only the scientific facts expressed by a language, but the language itself in which those facts are expressed. Basically, each scientific research has an aim to clarify, understand, comprehend, validate or check "some nature of reality" using a language. Language is the means of communication between people. However, the everyday or unscientific language, although unbreakably tied to scientific language, cannot fully meet with the needs of a scientific language and vice versa. In accordance to that, it can be spoken about two types of languages: a) scientific (object language and meta language) and b) everyday language. Accordingly, scientists use different languages, alive and dead, artificial, but also natural everyday ones, in communication or to express findings obtained through the process of research. In that way scientific facts, which can be true or false, that are expressed by a language, become the reason for scientific discussion. However, the subject

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of scientific discussion are not only scientific facts which on their own still do not mean anything, the subject of scientific discussion can be theories as well, which are also expressed by a language. Ristić (1995) reminds us: "In a certain scientific field, let's say psychology, one (or more) theory relates to a specific area of reality – for example studying- and speaks of it through appropriate language. But, the subject of human research is not only the reality, but also the very theory relating to that reality…" (p. 47). So, the problems of science intertwine with the problems of the language used. Only with the use of a language do scientists develop scientific knowledge.

Growth of knowledge through the use of a language is followed by certain problems. The problems can be of various natures- for example, transfers of terms from one language into another language. The mentioned problem has a sociolinguistic aspect, and Mišić-Ilić and Lopičić (2011) cite the growing use of pragmatic Anglicism in Serbian language. These authors cite that pragmatic Anglicism first appear in the spoken and later in the written language in different life activities.

Overcoming the mentioned problems usually has the goal of understanding the problem which is being researched. However, there are contrary opinions on how the language of science in a field of research should be arranged. It appears that reality can be reduced to two antipodes in applying scientific language. Mendeleev precisely ordered periodic table and it is hard to imagine the development of chemistry without the suggested symbols, signs and terminology which the said author put forward. Similar rules also apply to other science such as mathematics, physics or IT. For example, program artificial languages could be: machine program language, assembler and object oriented programming. Without the "mathematization of language" it would be hard to imagine the development of science. On the other hand, languages are completely differently used in religion, philosophy or pedagogy. For example, the concept "education" is differently interpreted by theologians, philosophers or pedagogues through the use of a language. The scope of the concept "education" ranges from the naturalistic understanding of education (bio-psychosocial understanding of education) on one hand, to the understanding of education as "an eternal sign" (symbolic-mystical understanding of education).

It is hard to mathematize the language used by theologians, philosophers, pedagogues or other authors of similar direction. Still, it seems that understanding has to go both mentioned ways, where mixing of scientific and everyday language is noticeable. In other words, it is necessary to use words, signs, symbols, terms and expressions which signify a concept precisely and clearly, but it is also necessary to comprehend how a researcher understands certain concept. The basis of scientific knowledge is the language in which the knowledge a researcher has made is expressed. However, the understanding of language is not the same for everyone. Words or sentences which are ambiguous, polysemious or have the same meaning can be often heard or read. It is no wonder when a researcher realizes the fact that no one can understand anyone completely. Marić (2008) points out to that fact: "Everyone speaks in the language of their own, which says that the others cannot understand them" (p. 23).

Romanenco and Nicitina (Романенко, & Никитина 2010) ponder over and point out to how new words in a language are made. The authors say that the entire process can be presented in the following simplified way:

SENSE→PICTURE→CONCEPT →WORD

Based on this assumption it can be said that when speaking about the interpretation of concepts, the least to bear in mind are: linguistic aspects, logic aspects and knowledge aspects. In further text a concept with all these three aspects will be talked about.

Everything becomes from a word. Word is the smallest independent language unit. By using words which have an explicit determined meaning (an expression or a term), a concept can be expressed. Accordingly, we should bear in mind that terms or expressions cannot be reduced to concepts. "The relation between a concept and an expression is really a relation between opinion and language, where the same thought material can be expressed in different words, and different thought materials in the same word", Ristić (1995, p. 52) notices. In accordance to that, Mishankina (Мишанкина, 2012) points out to the importance of *metaphoric models (the relation between knowledge sphere and language)* in the terminology systems of science. She adds that the metaphoric model relates not only to language phenom-

enon, but also to psychological one. So, the said metaphoric model is more to be understood as a means of gasping "the nature of reality", than as a language phenomenon. Cognitive linguistics deals with those and similar problems.

In the paper by Filipović-Kovačević (2012) a theoretic approach is suggested where the meaning is not contained in the very words, but in concepts. To a more complete understanding of this complex issue, observations of Alanović (2012) should be added, which remind us of complementary and unbreakable tie of syntactic and semantic sentence units.

Šušnjić (2007) points: "Word and concept point to the transition from semantic to logical analysis: from open to closed language" (p. 37). Even between the logicians there isn't a unique opinion on the logical analysis. But truth be said, some of the logical theories of concept can be accepted.

Petrović (2007) counted six logical theories of concept: formalist, psychologistic, nominalist, vulgar-materialistic, realistic theory of concept and the theory of concept as a thought on the essence of that what we are thinking about, and gave a critical opinion on each.

1. *Formalist concept theory*. Some logicians determine concept as an *element of statement*. Those who define concept as an element of statement, often define statement as a *connection of concepts*. If we say that a concept is an element of statement and a statement is a connection of concepts, then we surely learn something: we learn the relation between concept and statement. But we still do not learn what is neither concept nor statement.
2. *Psychologistic concept theory*. According to this conception a concept is just "*a general idea*", an idea about what is mutual to a larger number of objects. However, it isn't hard to see that what the psychologist call a general idea is still not a concept. A general idea, just like any other idea, is a real psychological experience, and that is where it already differs from a concept, which is an ideal logical creation.
3. *Nominalist concept theory*. According to this conception a concept is just a *word*, *a name (nomen) by which we mark one or more individual things*. It would be even more true to say that according to nominalist conception, there isn't any concept at all. This conception wants to eliminate concepts, i.e. to reduce them to words.
4. *Vulgar-materialistic and realistic concept theory*. According to *vulgar-materialistic* conception, a concept is a contemplative *reflection* of relevant (or necessary, permanent, mutual, general) qualities of *material* things. Sense, perception, idea, joy, sadness, anger and other mental processes are no material objects, yet we can have a concept of sense, perception, idea, joy, sadness, anger, etc. This remark is taken into account by the *realistic* concept theory, which is close to the vulgar-materialistic, but is also broader and more flexible. According to this theory, a concept is a reflection of relevant (general, mutual) qualities of *real things and processes* (not only material but also spiritual), as well as their *qualities* (hardness, beauty, kindness) and the relations between them (before, after, left, right, etc.). These two concept theories are founded on two basic wrong assumptions connected between themselves: the assumption that can think about something which exists independently from our thinking only and the assumption that our thought is only a passive reflection of that which exists independently from it.
5. *The theory of concept as a thought on the essence of that what we are thinking about.* According to this conception a concept is a thought on relevant characteristics of that what we think about (p. 17).

There are a great number of different kinds of concepts, and in the following text the concept classifications by Hegel, Petrović and Šušnjić will be shortly exposed.

Hegel (1979) originally classifies concepts: according to their clarity, into clear and unclear, into articulate and inarticulate, adequate and inadequate. The same author reminds of the relation of general and special and classifies concepts into complete and superabundant, contrary and contradictory, subordinate and coordinate concepts (p. 42). Further, Petrović (2007) classifies concepts according to the kinds of thought object into: a) concepts for things, concepts for qualities, concepts for processes, concepts for manner and concepts for relation; b) concepts for physical objects, concepts for mental objects and concepts for ideal objects; c) concepts for real objects concepts for imaginary objects (p. 23). Šušnjić (2007) classifies concepts into theoretic and

descriptive (descriptive, operational, experience and performance) concepts.

Following the short conception of concept classification according to various authors, the classification of concepts into *theoretic and descriptive* appears to be the one most acceptable for the needs of this research. In that explanation, the said author continues "…a theoretic concept remains inexhaustible by description of facts (left side is never equal to the right within a definition). Descriptive concept doesn't go over observed facts, it covers them as many as it has described, but never all: it organizes and encompasses sensory perception or empirical data" (p. 45). So, theoretic concepts cannot be reduced to observed facts and vice versa. Accordingly, we should bear in mind that too detailed classification of theoretic concepts can lead *to losing the sense of that what we are thinking about*. It should be added to this remark that each concept has its scope and content, where the content points to the relevant markings of a concept while scope points to the gathering of lower concepts included into a higher concept.

Besides language and logical aspects, here it should also be pointed to the methodological aspects, i.e. the aspects of the ways of learning scientific knowledge, while studying a problem. Actually, methodological aspects can serve us as Ariadne's thread in understanding the process of science. Mentioned methodological aspects relate to the growth of knowledge in an area of science which the researcher is researching and they are grounded on the basic paradigmatic beliefs: positivistic, postpositivistic, critical theory, constructionist, and participatory ones, which include ontological, epistemological, methodological and axiological assumptions (Guba, 1990; Guba, & Lincoln, 1994; Ristić 2011). The mentioned paradigmatic beliefs and ontological, epistemological, methodological and axiological assumptions can actually point to the broadness and depth in interpreting scientific facts. Aware of it or not, a researcher always belongs to some of the mentioned philosophic assumptions or beliefs. From such self-belonging perspective a researcher tries to understand what he/she is researching. That and such knowledge can be of great importance in a science. Such problems are actually problems of scientific truth, just as of the relation between philosophy and natural science (Фёдорова & Сулейманова, 2009; Шенкман, 2013).

"When talking about understanding the meaning of an expression, according to contemporary views, it isn't only important what the expression refers to (expression reference), but it is the intention of person using the expression in the given circumstances which is very important" (Ristić, 1995, p. 50). Since we express concepts using words (expressions or terms), it is very important what an author thinks when he/she uses an expression or a term, i.e. how he/she comprehends that expression or term. In fact, that is a relation between a definiendum and a definiens, or in other words a relation between what is being defined, for example an expression (definiendum), and what is understood under that expression (definiens). Besides this, it remains unclear what is defined by a definition, the content of concept, the meaning of expression or term, or the essence of the thing/object. In the following text it will be understood under the definition that the meaning of a word (expression or a term) is actually concept content, but it should also be noted that a *complete* reduction of the meaning of an expression or a term to mere concept content is not acceptable (concept is related to knowledge and is always a part of the expression).

Scientific knowledge is a dynamic process. The process is followed by understanding of scientific expressions or terms, concepts or problems. Accordingly, it is necessary to introduce the rules of defining as a criterion for validation, envisaging or knowledge of scientific problems. Since scientific problems contain expressions or terms, and expressions or terms are most often defined by as much as possible precise concept content, a question can be asked, what gives us the right to claim if a scientific expression or term is acceptable or unacceptable for a science community?

An insight into the regularity of defining an expression or a term or concept content could give us that right. Ristić (1995, p. 61) and Petrović (2007, p. 124) each counted nearly the same rules which could be considered universal for defining an expression or a term. Shortly, those rules relate to:

a) *appropriate defining* which directs that a definition mustn't be neither too broad nor too narrow. So, when defining an expression or a term (definiendum), it is the essence of the concept or the relevant markings of the concept (definiens) which have to be defined;
b) *circularity of defining* which means that a

definition mustn't contain a circle (it mustn't be „circular"). This means that the same expressions or terms cannot be used to explain each other. In other words, an expression or a term which needs to be defined mustn't be defined through an expression or a term whose meaning is even partially determined using the expression or term which needs to be defined. A definition contains a circle if definiendum appears within definiens;

c) *a definition should be clear, definite and unambiguous*;

d) a definition shouldn't be *negative*, but bear in mind that this rule is not absolute;

e) when defining, expressions or terms which are figurative, scenic and alike should be avoided.

When it comes to expressions or terms and concepts in sciences related to physical culture, some authors have occasionally raised their voice with the aim of pointing out the value and importance of this issue. Although, on one hand the voice has been raised (e.g. in 1994 the sixth number of journal Godišnjak was published under the title "A word on expert words"), on the other hand, it must be said that the scientific discussion on terms in sciences related to physical culture has not gone very far. There have been many themes, and few remas (new information). Matić and Bokan (2005) observe well the entire issue within the concept-meaning space of physical culture , and remind: a) that the discussion on concepts should be understood as a *continuous process* (comprehension), b) concepts should be perceived and accepted in the *analysis outcome*, and should not be taken" for granted", c) *concepts which are product of theoretical activity*, d) the process of analysis and choice of concepts should be understood as "*an open space*" or in better words, as *an open system* (p. 214).

It can be noted that at the each structure level of a science on physical culture, there is a (dis)agreement between what is written and what is meant. In other words, there are terms or expressions which have become common in our profession, for which it cannot be claimed with certainty in which measure they are appropriate for the content of the concept they refer to. In the most general sense, the disagreement of authors on the name of the profession and what is understood under the concept, can serve as an example: "Physical culture", "Kinesiology", "Sportology", "Human locomotion" and others. Besides the mentioned disagreements on the expressions or terms in the broadest sense, there are also some disagreements in the interdisciplinary, just as in individual (specialized) scientific areas of physical culture. In accordance to the fact that in our profession the interpretation of concepts can be performed at the said three levels, studying concepts, as well as terms and expressions for expressing concepts, can be of mostly scientific, just as of mostly practical nature. Analysis of concepts of scientific nature affects the analysis of concepts of practical nature, but not only that, the very practical work, too. In the following text the focus will be on the interpretation of basic concepts, just as on terms or expressions through which they are expressed in the theories of human motor abilities (TMA).

Based on the exposed issue referring to aspects of understanding concepts in science, it should also be deduced into the space of human motor abilities. In accordance, a *research question* is raised, i.e. *research issue:*

- *Is there a language, logical and knowledge agreement between the basic concepts in the theories of human motor abilities?*

The set research issue directs to review and new understanding of basic concepts in human TMA. Accordingly, the basic aim of this research is pointing to the possible language, logical and knowledge problems in interpretation and understanding of basic concepts in human TMA. This manner of review is not directed only to "mere understanding"; it can also lead to a new growth of scientific knowledge.

LANGUAGE, LOGICAL AND KNOWLEDGE ASPECTS OF TMA INTERPRETATIONS

Chelikovsky (Челиковски, 1978) gaves a great review of twenty-five human TMA, made in the period between 1956 and 1974 by world's leading authors, such as: Meinel, Gilford, Chlark, Semenov, Fleishman, Fetz, Kuchen, Zatsiorsky, Cratty, Verkhoshansky, Hodan and other. Among other things, the said author gave a look at methodological aspects, just as to concept structure of each TMA presented. The said author deduced some scientific assumptions from: a) formalized, b) constructive, c) reducing, d) molar, e)

molecular, f) classifying and g) mechanicist theories. He classified theories of motor abilities into: 1) empirical-intuitive, 2) theoretical-speculative, 3) structural or factor, 4) experimental, 5) structural-experimental (p. 41).

In Celikovski's paper (Челиковски, 1978, p. 44) various TMA are presented in detail, and besides methodological aspects it was also referred to the concept structure of each of the presented theories. According to the writings of the said author, for many scientists the concept structure of TMA consists from: *strength*, *speed*, *endurance*, *dexterity and/or coordination*, *flexibility*, *concepts which are contained in TMA in regards to*: three-dimensional scheme, psychological characteristics, structure of seven continuum theory, methodological approach.

The review given by Celikovski should be amended with conceptions of the authors who have given a considerable contribution to development of motor abilities theory. Matveev (Матвеев, 1977) divides the structure of motor abilities into: coordination, strength, speed, flexibility and endurance; Platronov (Платонов, 1999) into: speed, flexibility, strength, coordination and endurance; Zelajskov (Željaskov, 2004) into: strength, endurance, speed, coordination and flexibility; Bompa (2009) into: strength, endurance, speed, coordination and flexibility. Furthermore, with consideration to authors from Russian and English speaking area, the contributions to the understanding of this issue by the authors from Serbian speaking area are not be disregarded. Kurelić et al. (1975) divide the structure of motor abilities into: strength, speed, flexibility, balance, precision, coordination and endurance; Kukolj (2006) into: strength, power, speed, endurance, dexterity and flexibility.

After a TMA review, a great number of different concepts used with the aim of pointing to the structure of motor abilities can be noticed. If we took as the criterion the most represented concepts contained in the presented theories, agreement with the already accepted scientific knowledge from the area of motor abilities and the principles of theorizing in the said area, it can be concluded that the structure of motor abilities consists of: 1) strength, 2) speed, 3) endurance, 4) dexterity and 5) flexibility. In the following text, and in accordance with the suggested theoretical approach, interpretation of the said concepts will be presented in relation to: a) science language, b) logical concept theories, c) kinds of concepts, d) knowledge aspects, and e) rules of defining.

To make the interpretation of motor abilities concepts clearer, in the beginning we should differ between a) *by what* something is being explained and b) *what* is being explained. Making such a fine distinction in the interpretation of basic concepts can be of great importance in understanding theoretic and descriptive concepts. The structure of a motor abilities theory consists of theoretic concepts which must contain scientific facts. In other words, theoretic concepts in TMA must be in relation to scientific facts of empiric nature. On contrary, if it is only spoken about the scientific facts of empirical nature, researchers could bring themselves into danger of narrowing their own view on the nature of reality.

1. **Human muscle strength**. The things which numerous experts, in the field of studying motor abilities, have used to explain the concept of muscle strength are based on the knowledge of science on mechanic object movement, or specifically on the object movement dynamics. That knowledge actually belongs to the knowledge of classic physics, which was formed by the beginning of the twentieth century. Concepts from the scope of physics (force, velocity , power, object mass) will be used here to explain human motor abilities, but *by what* something is being explained and *what* is being explained should not be confused.

The texts of Morehouse and Rasch (1958),Кос (Коц,1986), Jarić and Kukolj (1996), Platonov (Платонов, 1999), Željaskov (2004), Mirkov, Nedeljkovic, Milanovic and Jaric (2004), Jaric, Mirkov and Markovic (2005), Zatsiorsky (Зациорский, 2009), Zatsiorsky (1995), Zatsiorsky and Kraemer (2009), Bompa (2009) brought to notice a great number of factors explaining muscle strength. In the broadest sense, strength can be understood as a human ability to, through muscle effort which produces certain force, exert certain muscle strength. In other words, muscle strength is the ability of exerting force during muscle effort. However, such a broad definition of *muscle strength* concept does not point to the content of that concept.

Since a muscle has the ability to produce force through effort, the values of exerted force can be various i.e. they can vary between minimal and maximum values, from F_0 to $F_{max.}$ The said values are expressed in newton (N). So, force is a quantitative size through which human qualitative abilities are explained.

Further, a difference should be made between the three ways of exerting muscle force: a) maximum

muscle force (F_{max}), used to explain maximum muscle strength, b) velocity force, used to explain velocity muscle strength and muscle power and c) exertion of muscle force during longer time period, used to explain endurance in both strength and muscle power.

In a situation where a human is producing maximum muscle force (F_{max}) or a force close to the maximum during an attempt of lifting or during lifting of an external load, which in the first case implies static condition and in the second case a dynamic conditions of muscle work – it is contained in the *maximum muscle strength* concept.

However, many human movements in various situations demand that, on one hand, a muscle during its effort produces the maximum force for the given conditions, and on the other hand, maximum velocity of muscle shortening. Because, according to second Newton's law, velocity is proportional to force and inversely proportional to object mass, it can be concluded that different muscle strength is produced during different movement velocities, which is closely connected to the mass of external load that is being lifted. So, in relation to exerted force, muscle strength can be exerted in the scope ranging from maximum to minimal values.

The concept of *velocity strength* has large content, and it implies the ability of neuro-muscular system to develop certain force in the shortest time possible i.e. at maximum velocity. Papers of Hill (1970), Kuznecov (Кузнецов, 1975), Verkhoshansky (Верхошанский, 1977) presented the conception force-velocity from which it can be concluded that by increasing velocity of shortening, the muscle force is decreasing. So, the velocity of muscle shortening is different in conditions when a muscle produces force which is e.g. 20%, 40%, 60% or 80% of $F_{max.}$

In physics, *power* is the product of force intensity and object velocity and it serves to showcase the velocity of work execution (P=F*V). Accordingly, during force exertion in the conditions of enough external load, and at the velocity of about 1/3 of the maximum possible muscle shortening velocity, an important mechanical characteristic of muscles is exerted which is marked by the concept of *muscle power*. Since *power* is a derived mechanic characteristic which explains *muscle power* in real human movements, it actually represents *a part* of previously mentioned basic postulates. Muscle power is a very important fact in additional understanding of basic postulates. As such, it can be further divided into concepts, but the scope of its divided concepts, just as the concept of *muscle power*, cannot be greater than the scope of muscle *strength* and *muscle velocity* concepts.

The contents of the *maximum muscle power*, *velocity strength and explosive muscle power* concepts, which are often found in literature, can overlap in some conditions i.e. the concepts can in a certain sense be perceived as synonyms. Namely, *maximum muscle power* is exerted in the conditions when a muscle exerts force of about 50% of F_{max} and at the maximum velocity of muscle shortening, proportional to the said level of exerted force. Such demands for maximum muscle power (P_{max}) exertion, relatively large muscle force accomplished and relatively high velocity of muscle shortening, have brought to the merging of velocity and force concepts into *velocity force*. So, in the supposed conditions of velocity force (velocity and force of muscles) maximum muscle power (P_{max}) can be exerted.

The *explosive muscle power* concept is a concept relating to the human movements for developing quickly the largest muscle force in dynamic work conditions. Since *explosive muscle power* concept doesn't necessary refer to an exactly specified exerted force, or muscle shortening velocity, it is not hard to notice that the demand for exerting maximum muscle power (P_{max}) can be set as a demand for exerting explosive muscle power. Furthermore, maximum muscle power (P_{max}) represents nothing else but the said level of muscle force and velocity, or *velocity muscle strength*. However, such understanding cannot be applied in the situation when muscle force is exerted at the velocity that is inappropriate to the conditions under which maximum muscle power ($P_{max)}$ is accomplished. The concepts of *explosive muscle power and maximum muscle power* are described through physics concepts of force and velocity and can be interpreted in the discussed manner. Also, the *velocity strength* concept is described through physics concepts of force and velocity, but it is interpreted in a different manner. The same concepts cannot be used to explain each other.

Endurance in strength concept contains the duration of the high enough values of exerted muscle force, or the muscle ability to oppose fatigue for a long time period. It should be emphasized that endurance in muscle strength can be exerted in two cases: a) the great number of a movement repetition (dynamic

muscle work conditions), where produce certain muscles force and b) long opposing to external load in static conditions of muscle effort. The reader probably recalls and observes a different manner of speaking already mentioned in the velocity strength section. It refers to muscle power. So, it is correct to say that muscle power appears in the conditions exerting certain muscle force and muscle velocity; hence here we can also speak of endurance in muscle power if an activity lasts over a long time period. On the other hand, when a muscle is exerting maximum force or force near the maximum value, over a long time period, in static conditions or at low muscle shortening velocity, it is only possible to speak of endurance in maximum muscle strength.

Besides the given relations of an activity's *force and velocity, force and duration (time),* muscle force can also be in relation to the *complexity* of an activity. Such relationship can be represented by the activity's *force-complexity (coordination) ratio*. Based on the previous exposition, it is not difficult to observe that the maximum muscle strength (maximum exerted muscle force F_{max}) is exerted in the conditions of: a) minimum velocity, b) minimum duration and c) at the minimum complexity of a certain activity.

In accordance to previously stated claims that muscle strength is in direct relation to velocity, duration and complexity of an activity, it is practically *impossible* to define muscle strength concept. It is possible to define structural elements of muscle strength concept, e.g. maximum muscle strength, velocity strength, muscle power and endurance in strength. Therefore, strength is a three-dimensional theoretical concept, and its structural elements represent descriptive concepts filled with facts and can be interpreted depending on the specificity of movement performance, attempt of movement and motion.

2. Human speed. In physics, the value (intensity) of velocity is determined by the distance and time relation. Speaking of motor abilities, speed concept comprises human ability to perform a movement or motion at maximum velocity for given conditions. It can be observed in the papers of Verkhoshansky (Верхошанский, 1981), Wisløff, Castagna, Helgerud, Jones, & Hoff, (2004), Cronin and Hansen, (2005), Sheppard, Young, Doyle, Sheppard and Newton (2006), Nummela, Keranen and Mikkelsson (2007), Verkhoshansky (2007), Gabbett, Kelly and Sheppard (2008) that human speed has been investigated in various manners, and that it is conditioned by different factors which explain it, but the specific thing is that human speed is investigated based on the movement performed at maximum speed in short time interval on a rectilinear path. Such rectilinear motion, on short distances at maximum possible speed can be seen as relatively simple. Namely, the said motion is rectilinear, but it is uneven i.e. different parts of path are crossed in different time intervals. Platonov (Платонов 1999) is fully justified to remind that activities demanding optimum speed level can be divided based on elementary and complex manifestation forms (p. 248).

Besides being rectilinear, motion can also be curvilinear and, as such, object of speed study. However, studying complex manifestation forms of human speed demands additional explanation.

In accordance to already said on human speed, we should bear in mind that speed can be explained based on relations of velocity and time (duration) of an activity, muscle force exertion, and the complexity of motion needed in performing the given activity. In other words, human speed concept is a three-dimensional theoretical concept and it cannot be understood without knowledge of these relations: *force-velocity, velocity-time and velocity-complexity (coordination).* For example, *maximum human speed* concept should be derived from said relations and it contains: 1) maximum fast human motion in short time interval 2) maximum fast human motion at minimum external load (minimal exertion of muscle force) and 3) maximum fast motion performance in the conditions of minimal requests from the aspect of complexity (coordination). Such understanding of speed is characteristic exclusively for rectilinear motion.

We should bear in mind that based on the said relations relating to human speed, a certain strength can be manifested within speed, then endurance in speed can be manifested when talking about work duration, while it can be demanded from a man to perform a complex motion maximum fast for given conditions. A distinction should be made here between "ideal" conditions where maximum human speed in rectilinear motion is manifested, and "changeable" conditions where maximum speed is also manifested, but in complex curvilinear motion. Certainly, those speeds are not the same and they cannot be interpreted in the same way. For example, it was already talked about the concept of maximum human speed,

but when talking about movement which demands a certain level of force, complexity and motion duration (minimal duration of maximum intensity in this case), it is about human *agility*. Agility is a derived, descriptive concept from force-velocity, velocity-time and velocity-complexity relations and it represents an additional fact, a part of content, for the explanation of *human speed* concept.

Since human speed concept has its structure, it is known that high speed is not conditioned by individual elements and that it depends on its total manifestation. However, talking about speed structure based just on basic forms of its manifestation doesn't give the complete insight into the content of speed concept. Accordingly, to the individual (basic) elements of manifestation of speed on a certain path, which can be rectilinear or curvilinear and can be divided into short parts of different duration, a time structure of speed manifestation should be added, as well as structure from the aspect of complexity and structure from the aspect of muscle strength exertion clearly, additional structures are based on different basis.

3. Human endurance. In the broadest sense, the content of human *endurance* concept comprises of the ability to perform given activity over a long time period, i.e. the endurance represents human ability to oppose fatigue. However, such a broad understanding of endurance definition doesn't reveal the content of human *endurance* concept. Endurance can be classified in various manners, and each of the manners has its background telling what endurance depends on. A look at the papers of Verkhoshansky (Верхошанский, 1980, 1984), Jeukendrup, Saris, Brouns and Kester (1996), Wisløff, Helgerud and Hoff (1998), Bassett and Howley (2000), Moreau, Green, Johnson and Moreau (2001), Laursen, Shing, Peake, Coombes and Jenkins (2002) leads to conclusion that endurance is determined by various factors, and the very concept of endurance should be understood based on three relations (dimensions) discussed in the following text.

It has been already said that the *duration* of an activity is linked to endurance, but the data on duration of an activity still reveal nothing themselves. Human endurance (long duration of an activity) is closely connected to: 1) exertion of muscle force, 2) velocity of activity performance, and 3) the level of activity complexity (coordination). Based on synthesis of scientific facts, three new relations can be derived which are essentially contained in the human endurance concept. The relations are: *duration-force, duration-velocity and duration-complexity*. Each of the mentioned relations has its relations which are of logic nature, e.g. performance of an activity at the maximum possible velocity is not possible over a long time interval. Accordingly, it is easily observed that human endurance concept cannot be clearly defined, only its content (structural), or descriptive, elements can be described, such as endurance in speed, strength or dexterity of an activity. Since each of the said relations has its scope, the nature of reality is further complicated.

Above all, it should be observed that human endurance is linked to activity duration, and the longest duration can be in the situation 1) of minimal strength exertion, 2) at minimal speed and 3) at minimal motion complexity.

4. Human dexterity. The concept of *dexterity* points to understanding of coordination i.e. the complexity of motion. Here the concept of *complexity and/or coordination* is understood as the *arrangement* of activity performance, which depends on numerous factors explaining what human dexterity all depends of. In Anglo-Saxon literature the concept of coordination is simply used, however the use of a concept when explaining something and when something is being explained can very easy lead to the problem of circularity in defining a concept.

In their papers Platonov (Платонов, 1988), Ljah (Лях, 1989), Rodacki, Fowler and Bennett (2001), Rodacki, Fowler and Bennett (2002), Kizljima (Кизыма, 2005), Cheliasev (Челышев, 2012), Zaporozanov (Запорожанов, 2013) explain dexterity based on numerous factors affecting manifestation of relatively complex motions, and all those factors actually answer the questions what is complexity, or coordination, of an activity like in relation to exerted velocity, force and time interval in which the given activity is performed. Hence, when the concepts explaining dexterity are connected, it is easy to derive three relations on which dexterity is dependent on*: complexity*-velocity, *complexity-force and complexity-time*. Derived relations are mutually connected meaning that if motion complexity is high, the velocity is relatively low and vice versa. The same rule applies for the other two relations.

From the said it follows that the highest level of dexterity demands the highest level of coordination,

or motion complexity. So, the most complex human motions can be performed in the conditions of: 1) relatively low velocity of motion performance, 2) relatively low exerted muscle force in motion, and 3) relatively short time interval in which certain motion is being performed. However, a man can perform motions of a certain level of complexity under different conditions, conditions not relating to already mentioned ideal conditions for dexterity manifestation. Accordingly, dexterity concept cannot be clearly defined either, only certain parts of dexterity can be defined which actually contain facts on which dexterity is dependent on, and those facts point to the complexity of movement (coordination), and are in the direct relation with the relations explaining dexterity.

5. Human flexibility. The concept of flexibility represents, in the broadest sense, the ability of performing a physical activity in great range of motion. Accordingly, the flexibility concept is often related to elasticity and muscle length. So, understanding flexibility points to the importance of optimal muscle length in different types of activities. However, with many activities the flexibility appears as the result of synergy of various types of muscles contraction.

Physical activities of great range of motion are conditioned by numerous factors (Pollock, et al. 1998; Nelson, Driscoll, Landin, Young and Schexnayder 2005; Knudson, 2008; Bozic, Pazin, Berjan, Planic and Cuk 2010; Фиринская, 2011). All these factors have been used in the attempts to answer the question what happens with the change in muscle length in various physical activities which demand high flexibility, i.e. great range of motion during motion, body part movement or a particular position.

We should bear in mind here what explains the flexibility concept. However, as in the previous sections concerned with concepts making up TMA structure and their interrelations, flexibility concept in real activities cannot be deeply understood either, if not brought into relation to other motor abilities.

It has been already said that at the elementary level flexibility can be understood based on demands for higher muscle length, hence follow four new relations explaining the content of human flexibility concept and which complete the manner of explaining entire space of motor abilities. Those relations are: *length-force, length-velocity, length-complexity (coordination) and length-duration*.

It is worth the mention that based on the said relations, the highest flexibility can be manifested in the situations: 1) of relatively high forces affecting the length of muscle stretch 2) of relatively high speed of muscle stretch, 3) over relatively long time period when a muscle is stretched and 4) motion performance demanding high complexity (coordination). It follows from the given that flexibility in its most elementary form can be manifested while holding a certain body position, to the most complex forms of exerting flexibility in the activities such as: rhythmic gymnastics, gymnastics, figure skating, synchronized swimming, etc. Besides everything said so far, let's remember that the TMA structure consists of considered theoretical concepts which can be explained based on the ten given relations.

TOWARDS NEW PARADIGM IN TMA INTERPRETATION

The *answer* to the first part of the set research question should be found in the discussion on the type of language used in the knowledge of structure of motor abilities in different theories. If looking at the conception of Celikovski (Челиковски, 1978), who wrote about the division of motor abilities, it was said before, based on the way of abtaining knowledge it is clear that TMA concepts came from pure empiric facts. And the language used to explain those facts was object language. Of course, it could not be done other way; it had to start from something since that was when the science on physical culture started developing. In later established theories, writing was more precise and clearer and the theories are more grounded.

On the other hand, there is hardly any meta language in TMA research. Many times mentioned Celikovski gave the biggest contribution in that sense and back in 1976 reminded that none TMA has its own meta language. It should be said that in text Kukolj (2006) used meta language in a certain amount, to explain human motor abilities based on the wholeness of a human. Also, in the text of Zatsiorsky (Зациорский, 2009) some elements of meta language can be noticed which put motor abilities in the context of physical education.

Accordingly, there is agreement in object language; however there is disagreement in the use of object and meta language when writing about motor abilities. Object language was rarely analysis subject. Hence, researchers should devote more attention to grounding TMA on object language, and after that the focus should be on requisitioning of all existing TMA. It means that numerous experimental researches being conducted over the world and are filled with facts, can have their full sense only if shaped by a theory or if interpreted based on a theory. Besides this, we should warn that in English to Serbian translations there are more and more pragmatic Anglicism being used, which due to cultural differences further complicate understanding of object language and interpretation of basic TMA concepts. Pragmatic Anglicism silences the object language, not to mention the meta language.

Following the discussion on the types of languages used in TMA, the interpretations of basic concepts in relation to logical concept theories will be discussed. If concept interpretation is observed in relation to *formalist concept theory*, it can be concluded that in TMA, the concepts are not interpreted as a "mere" connection between concepts in a statement. If such principle applied, it could not be talked about concepts. We wouldn't know what is neither concept nor statement in TMA. When talking about the interpretations of basic concepts in relation to *psychologistic concept theory*, it is not difficult to notice that many experts in studying motor abilities have had a "general assumption" about the structure of motor abilities. Researchers were at the same time trying to explain concepts logically, in accordance to current theorizing principle. Accordingly, psychologistic theory can also be considered inadequate for the context of the given issue. In *nominalist conception*, the concept is virtually disregarded, the importance lies not in the concept but in the word. Because of that it is unacceptable to relate basic TMA concepts to nominalist conception, since scientists researching motor abilities have greatly dealt with defining content of basic TMA concepts. There should be a special focus on whether there are slight differences between *vulgar-materialistic and realistic concept theories*, i.e. to the fact that most researchers have tried during a discussion on basic TMA concepts, to point to the relevant qualities contained in concepts, so it can be said that the realist understanding of concept is the one most common in TMA. *So, there is a logical agreement while interpreting TMA concepts in relation to realistic concept theory.* Accordingly, it should be emphasized in the end that the interpretation of basic TMA concepts in relation to *the theory of concept as a thought on the essence of that what we are thinking about*, in a way acceptable, but the criterion of what is "essential" remains unclear.

Besides understanding the reality of TMA concept relations and concept theory, the discussion on logical aspects should be completed with classification of concepts into theoretical and descriptive. Accordingly, the structure of motor abilities theories consists of theoretic concepts: *strength, speed, endurance, dexterity and flexibility*, and not of descriptive (derived concepts) e.g. agility, velocity strength, explosive power or muscle power. Theoretic concepts search for connection to facts and facts constitute the content of theoretic concepts. Theoretic concepts are basic concepts and other concepts are deduced from them. Derived concepts are deduced concepts of lower order and therefore cannot have a larger scope than the basic concepts.

For the knowledge of scientific truth, it is needed, although not necessary, the knowledge of assumptions on which the knowledge is grounded. Most TMA are grounded on pure positivist assumptions. This way of learning follows the entire science on physical culture, while Bokan (2013) reminds that such knowledge is grounded on *physical antropology and inductive manner of concluding*. Few authors have tried to explain the totality of human motorics (antropomotorics), and their beliefs are not „purely positivist". Since the inductive manner of concluding followed by quantitative research tradition is characteristic for positivists, we should bear in mind that with such manner of concluding it is easy to lose insight. The danger is larger if the facts find no sense in an organized system-theory. On the other hand there is very little qualitative research in the area of motor abilities. This doesn't mean that they are unnecesary, they are needed for amore complete scientific *dialog*. It is unimaginable that a science is developing on the grounds of only one research tradition. Hence, a collective scientific dialog should be started on the scientific truth in TMA and in accordance with what Guba said back in 1990: Not for a paradigm to win, but to

form a new, more acceptable paradigm (p. 27). Truth be said, collective dialog in a knowledge process has to be completed by an individual dialog. A dialog with oneself, internal dialog or individual effort. Jerotić (2013) remind that a man advances towards *maturity* most successfully only in „the opinion battle" (internal, but with others too) which is followed by emotions (p. 20). As scientific truth assumptions and dialog, as TMA concepts. So, *there is a knowledge agreement in TMA concepts interpretation, but the agreement is based mostly on positivist beliefs.*

Finally, but not less important, we should point to the rules of defining. A great problem arises in translation from a language to antother, most often from English and Russian to Serbian. In such translations, since knowledge beyond linguistic one is needed, the same concepts are often used (defined) in two different contexts, i.e. the same concept is used to explain what is being explained. It does not mean that the authors have misdefined a certain concept in their mother tongue. However, inadequate translation increases the unclearity of concept content. These rules, mentioned in the introduction, readed should bear in mind, because we will organize practice in the way we define concepts.

Above all, if the entire TMA concepts discussion could come down to one sentence, than, instead of a conclusion, a tought by the great Russian thinker Berdyaev could mirror everything writen: „ The creative activity of man is also present in objectification, for example, in amazing mathematical discoveries, but it is even more present in overcoming objectification, in the methaphysics which has reached the essential and existencial" (Berđajev, 2002, p. 32).

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DEUTUNG DER GRUNDBEGRIFFE IN THEORIEN DER MOTORISCHEN FÄHIGKEITEN DES MENSCHEN

Zusammenfassung

Ziel dieser Untersuchung ist es, auf mögliche sprachliche, logische und kognitive Probleme inDeutung und Verständnis der Grundbegriffe in Theorien der motorischen Fähigkeiten hinzuweisen. Diese Weise der Hinterfragung ist nicht nur auf „reines Verständnis" ausgerichtet, sondern kann auch zum „neuen Wachstum" der wissenschaftlichen Erkenntnisse führen. Dementsprechend wurde die Frage bzw. das Problem derUntersuchung gestellt: *Bestehtsprachliche, logische und kognitiveÜbereinstimmungzwischen den Grundbegriffen in Theorien der motorischen Fähigkeiten des Menschen?* Die Antwort auf die gestellte Untersuchungsfrage weist darauf hin, dass eineweitgehendeÜbere instimmungzwischen den Grundbegriffen in Theorien der motorischen Fähigkeiten im wissenschaftlichen Dialog zwischen Forschern unterschiedlicher Überzeugungen zu suchen ist.

Schlüsselwörter: THEORIE / STÄRKE / KRAFT /GESCHWINDIGKEIT / AUSDAUER / GESCHICKLICHKEIT / KOORDINATION / BIEGSAMKEIT

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