

## THEORY AND PRACTICE OF RHYTHM IN THE PROFESSIONAL TRAINING SYSTEM FOR ATHLETES AND TEACHING STAFF

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**Abstract.** *Background.* Rhythm is important for the implementation of all processes as in nature and in living organisms. It organizes motor human activity making it more productive and rational. On teaching working and sports motions the process of the impellent work correct rhythm assimilation plays an important role because it determines the movement performance optimum that is shown in its automation process reduction. As a result, man's physical strength and nervous energy are saved. Rhythm category acquires a special status for the physical training specialist. All his activity including the motor component depends on the rhythm. The aim of the research is to study the physiology of rhythm and justify the more efficient training process for future teachers and coaches. *Methods.* The following theoretical research methods were used: the abstract and axiomatic methods, analysis and synthesis, induction and deduction, idealization, comparison and generalization. *Results.* As a result of study of materials from the natural sciences, numerology, psychology, music, cybernetics, synergetic, physiology, was found that the change of different states, as in nature and in living organisms, is an undulating rhythmic character. Physiological basis of the same rhythm is dynamic change excitation and inhibition processes occurring in the central nervous system. In this paper features of rhythm were identified. To accelerate the assimilation of motor action rational rhythm it is necessary to develop a sense of rhythm which is successfully formed in during the musical-motor activities. *Conclusions.* For today the study of the rhythm phenomenon in professional preparation on physical education and sport, in our opinion, requires the further study. Adding exercises involving certain motor skills elements similar in rhythmic structure with professional and technical actions to the coaches and teachers education and the competitive technology formation should be indisputable.

**Key words:** rhythm, motor action, professional preparation, coaches, teachers.

### **Introduction**

"The world is ruled by the rhythm. Cepheid stars rhythmically pulse, waves rhythmically billow, hearts rhythmically beat, day and night, and seasons are replaced. To a certain rhythm, ..., is corresponding the phases of mountain formation.... There is the precise rhythm in climate changes.... The rhythm is for all beings – a lot of birds, fish and animals perform seasonal migration, most of plants have seasonal life rhythm. But the rhythm laws seemed to permeate our world deeper that it can be supposed" [20].

Even the ancient noticed rhythmic character of many life phenomena starting with the seasons and corresponding changes of nature and a man and ending with the rhythm in music and different peoples' languages.

The continuous change of qualitatively different states in nature as well as in beings defines wave rhythm characteristic. Waviness is shown as a result of some heterogeneous reason clash. Some process increases and decreases do not just occur, the certain phase change is observed. Every wave is something achieved, and next wave showing something like cumulative effect, stratifying on the previous one is defined by any further penetration. This rhythmical process must not be compared with going round in circles where everything is back to the point of reference. There is the spiral motion like we have such return but on the next level every time. The more complete this process, the more noticeable its creative character. It is marked in rhythmic processes of life where their structural and creative character can be spoken about.

### **Material and Methods.**

Rhythm category gets special status for physical education specialist. All of his or her activities including motor component depend on the rhythm laws. The aim of the investigation is to study the physiology of rhythm for improving the process preparation of teachers of physical education and coaches. The research used the theoretical investigation methods: abstract and axiomatic methods, analysis and synthesis, induction and deduction, idealization, simile and generalization.

### **Results of the study.**

The scientist-physiologist Perna N. (1878 – 1923) in his work, "Man's Life" [17], presented all life processes as the wave-like rhythmic processes and justified every new wave of this process as a new achievement stage. He analyzed the physiological rhythms at the separate tissues and organs level and resulted that rhythm is for every organism process without exceptions. On scientist's opinion the people who "concentrated on their inner spiritual life", musicians, poets, philosophers, artists, have more expressed long-term rhythm. The wave-like life according to Perna N., however, cannot be found at people of practical activity. It is probably due to natural professional selection as far as the scientist says that practice needs to react to external impulses quickly and precisely. The people having expressed periodicity in their spiritual life are not always able to do it. As for scientists Perna N. notices that they are between those two categories mentioned above.

Rhythm is the most important forming characteristic of the spatial unity, so it is one of the universe and worldview background. Morozov N.D. [16] justifies historic event cycle in this context. He says that due to cycle laws

the events within any historic period can be forecasted drawing an analogy between modern and ancient worlds. All historic events developing spirally are accurately cycled complying with mathematics laws, and it is impossible to resist this process. Morozov N.D. notices that knowing the repetition algorithm of historic processes the program to analyze future changes in the society can be created.

The researcher calculated so called “polar cycle” and mathematically proved that it is the natural model of the planet rhythm phase interaction. Its stages and periods effect on our life.

In 1881 Sechenov I.M., world known physiologist, was the first who managed to observe the right rhythmic occurrence of voltage in frog’s medulla oblongata according to the respiratory process rhythm. It shows the fact that this rhythm changes and can be disrupted stopped if they are influenced by the afferent nerves injuring. It was the respiratory period that the physiologist used as circumstance helped to define that the rhythm of voltage occurrence regarding the impulses from afferent nerves transforms and is blocked according to the same laws as well as the respiratory rhythm itself does [18].

The continuation of physiological theory of rhythm can be observed in the works written by Ukhtomskii A.A. His dominant model presents the cooperation system of the processes where rhythmical, oscillatory processes of subsystems are the system forward movement basis. From this point of view we can say that the dominant integrates separate processes from diverse fields together due to “the driving rhythm” drawing them into resonance, and these constellations can be stable. The rhythmic influences from initiative centre gradually include new and new components into harmonic activity areas because these ones can perceive the rhythm specified and be set according to it. “Monotonous operating march at ongoing work is only achieved by mutual co-setting up on some average “sympathetic rhythm” of the work in more labile and less labile components of central constellation” [19, p.219]. According to the utterance given to us are allowed to analyze the problem of rhythm reception.

Sechenov I.M. [11] was the first who highlighted the sense organs’ role in time perception. He believed that temporal features of objective reality, a person perceives through a system of analyzers. The auditory organ and kinesthetic sensitivity organs become the most important of them. Motor analyzer sets the interaction between different analyzers (perception of space, time) a man comprehends the surrounding reality.

Pavlov I.P. and his students realized the farther experimental study of theoretical conceptions on analyzer’s activity connected with conditioned reflex. Having established the concept of conditioned reflex Pavlov’s school [10] showed that time is the same stimulus such as visual, acoustic, tactile and so on. In addition, it was proved experimentally that the time perception is carried out with the help of analyzers uniting into a kind of system, acting as a unit. This fact, in turn, determined connection of rhythm assimilation with all analyzers activity. To understand physiological mechanism rhythm sense the great interest is for the cortical processes of duration perception, quickness perception and the sequence of stimuli i.e. those parameters which are characteristic of rhythm.

Pavlov I.P. [10] established excitation and inhibition processes existence in every main process occurring in nervous system. Besides excitatory process attenuation, change by inhibitory process has a wave-like rhythmic character. So the peculiarities of central nervous regulatory processes and external activity of efferent apparatus have all main features of the rhythm for motion. The dynamic stereotype formed this way in motor activity is a balanced system of excitation and inhibition cortical processes which are perceived with sufficient stability in time and space under these conditions.

We see the role of cortical stereotype at motion apparatus rhythmic organization in Vinogradov’s M.I. researches. While studying labor processes physiology he revealed that at the process of conditioned reflex elaboration “the new rhythmic process, this or that, periodicity of excitation state changes in nerve processes” is created for a while [13].

The famous physiologist Kvasov D.T., Ukhtomskii’s student, showed the rhythmic motion regulation by cerebral cortex hemispheres [15]. He was one of the first who used the method of rhythmic motion electrophysiological research, confirming once more the thesis that the motion automation does not connected with motion regulation transition into sub cortical centers, but it must be considered as the stable fixation of temporary connections in cerebral cortex hemispheres.

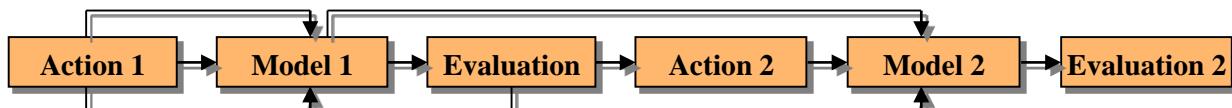
Thus, we can conclude that cortical parts of the brain play leading role in time perception process. Conditioned reflex activity is a basis of the time perception; the neural processes occurring in it have the rhythmical character. The dynamic change of excitation and inhibition processes in nervous system is the physiological basis of the time perception and, therefore, the sense of rhythm.

For the time conditioned reaction formation as a physiological mechanism underlying the rhythmic movements the readers are referred to a number of the works on physiology written by other scientists such as Bechterev V.M., Alexeev M.A., Vasiutin A.I.

The rhythmic processes importance and turning them into the same rhythm while combining a holistic process are noticed in cybernetics and synergetics paying attention to the essence of complex systems self-organization.

Norbert Wiener, an American famous mathematician and philosopher, the originator of cybernetics and artificial intelligence theory marked “... nonlinear interaction creating the gravity of frequencies can originate self-organizing system, ...” [14, p. 293]. The researcher studied the brain electrical wave origin, as a result he discovered that they go through the sequence of positive and negative phases before calming down. This fact, to some extent, explains the theory of brain waves self-organization. These waves, in turn, promote the organization rhythm of individual human organs and systems rhythm. So, the diurnal rhythm is about 23 ½ hours. It is observed in many living organisms. This rhythm can be turned into 24 hour rhythm of day and night by the environmental changes. Biologically it is not significantly if the living organism natural rhythm is 24 hours exactly providing it can be drawn to 24 hour rhythm by environment” [14, p. 290].

Amosov N.M., a Ukrainian cardio-surgeon and cyberneticist, in his works paid attention to the fact that "... while designing the real systems of "artificial intelligence" it can be reasonable to show some functions of the mind as network models, others – as algorithmic ones" [1, p. 11].



*Fig. 1. Chain of actions as "activity tacts" according to Amosov N.M. [1]*

Figure 1 shows the algorithm of actions with models implementation. Herewith every next model is chosen as a result of elementary action taking into consideration the links with the previous models within some "tacts". Besides, to perform actions it is necessary to have a stimulus that defines the activity level of the model chosen making it generate energy according to its "input" – "output" characteristic. The other models and stimulus energy is considered at the "input". For example, the stimulus energy is considered for **Model 2** not only from **Action 2** but from **Model 1**.

Scientist says that the action model is a part of the program where the hierarchy can be revealed: from the actions "in general" in any event chain to the concrete action with a model. Besides, the necessary condition of this program must be some "tension" as an activity level being the need or stimulus for this or that activity.

Kurdiumov S.P., a scientist, specialist in Mathematical Physics, math-modeling, Plasma Physics and synergetics, said the same: "The complexity of the structure is associated with coherence. The coherence is the coordination of the structure life paces by means of diffuse, dissipative processes being macroscopic manifestation of chaos. To create complex organization it is necessary to connect substructures inside it, to synchronize the pace of their evolution. As a result, the structures get into the same tempo-world, thus they acquire the same exacerbation moment, start "to live" at the same pace. To create the complex structure it is necessary to be able to connect the structures of "different age" developing at different tempo of the structure, memory elements must be turned on" [9, p. 104].

We should mark that rhythm is brightly shown at the human motor activity doing sports, athletic movements as well as in every day life. The motor rhythm is presented by different time correlation of motion strong accent parts connected with active muscular efforts and tenses, and weak, passive movement phases. In other words, the motor rhythm can be determined as coherently organized distribution of the efforts in space and in time. Both cyclic movements presenting periodically repeating cycles (walking, running, jumping with jump ropes, rowing etc) and acyclic (one-act) forms of movement (jumping, throwing) have rhythmic characteristic. Any complete motor act is performed rhythmically, thus, it will be performed either rationally (rhythmically right) or irrationally (breaking the rhythm that is the correlation between movement parts duration.) It should be noted here that we must not say there is no rhythm in the movement at all. In this aspect the *rhythm* features are:

- the natural ratio correlation of the elements duration. These elements form the complex structure of the process given and present the definite rhythmic pattern;
- the elements difference according to the force. The difference is expressed by emphasizing/accentuating in sound or motor form;
- form-building importance of the rhythm that unite the process elements and the structure of the process given has its inner regularity and certainty;
- manifestation of emotional character. It is connected with the effect of rhythmic pattern different forms on the emotion centre.

Thus, rhythm is an important thing for processes performed by people at any activity. It organizes the motive activity, makes it more efficient and rational. The process of the right motive rhythm adoption is very important for labor and sports movement teaching because it presents the optimal option of movement performing. It is exercised at shortening the process of its automation. As a result man's physical strength and nervous energy are saved. To learn the rational rhythm of motor actions as soon as possible we must develop a sense of rhythm that is understood as person's ability to distinguish with great fidelity his motion in time, in space and according to the efforts expended.

A sense of rhythm can be considered as specialized perception generating in the process of motor, music and other human activities. It is a basis to educate all types of coordination that will help to achieve the great results in any activity.

A number of scientific works studies the rhythm sense problem. The researches made by Teplov B.M., a professor, an outstanding psychologist, have a special place among them. He showed in his work "Psychology of Musical Abilities" [12] that the sense of rhythm has the motor nature. The rhythm perception has never been only the aural one. It is always auditory-motor process. Experience, by itself, is always active. You must not simply "hear the rhythm". A listener only experiences the rhythm when he "co produces", "co does" it, that is expressed in peculiar experience of the activity "sense of activities".

Thus, music perception has the auditory-motor character. Learning the music rhythm we form movement performance rhythm itself.

Foreign psychologists such as Roger McDouall [5], Thaddeus Bolton [3], Kurt Koffka [8] and others highlighted the active, efficient motor nature of the rhythm perception.

This statement has a great importance at specialists training in the sphere of physical education. Along with the pedagogical skills a teacher of physical education at institutions as well as organizations which are for physical development and health promotion must manage specific musical and rhythmic/motor skills. It is particularly for coaches of different types of fitness, especially in aerobics where the skills given are necessary for training. It includes the following: conducting exercises in accordance with the musical-rhythmic composition; implementation of rhythmic counting in accordance with the musical measure; timely submission of commands and special gesture for starting and ending the exercise; implementation of methodological comments and instructions in accordance with the rhythm of executing the movements.

Athletic coach faces this problem forming the exercise technique. It has special rhythmic structure (in each sport) supposing optimal implementation of these exercises. It means that a coach should have appropriate professional skills showing the exercises as well as explaining them.

The basis of skills mentioned is a sense of rhythm that can be developed by those people who have not this sense and can be improved by those who spontaneously showed it with birth.

#### Discussion.

We can suppose that working-out of rhythmic patterns of every motor action (professional, competitive) and the following practice can promote coaches-teachers' faster learning as well as sport activities. In other words, the law of skill positive transfer will be reflected here. It is very important at the beginning stage of pedagogical studying at higher education establishment and at the beginning stage of the training in any sport. Both in the first and second cases, the process of professional and technical actions formation is consecutive from initial to linking and partial skills where rhythmic patterns will be the fundamental fixed basic points. In our opinion, adding the exercises that include definite elements of motor skills to the process of coach-teacher education and competitive technique formation must be without controversy. These skills are similar with professional and technical actions according to the rhythmic structure.

The investigations, made by Aftimichuk O.E. [2], Craijdan O.M. [4], Faur M.-L. [6], Gönczi-Raicu M. [7] have confirmed this fact. Their works have the same aims: improvement of sportsmen and profile specialists' training process, and the objectives, the main of which are: development of rhythm sense with musical and rhythmic education, formation of pedagogical and sports activity's rhythmic structure.

To solve these problems we focused on the main tasks: creation of rhythmic patterns and their coordination with structure of any motor action. Thus, the researches had to study music basis (which is included in the program of university discipline "Musical and Rhythmic Education").

The problem of competitive activity's rhythmic structure has always been actual for investigations in lots of sports. There is a lot of information in literature on biomechanics of motor action locomotion in cyclic exercises. It has been analyzed to some extent in acyclic sports. Meanwhile there are not materials on the methodology of the motor action rhythmic structure formation in scientific and methodological sources. The scientists often research the motor action formation and its phase character without taking into account the methods of education.

Speaking about professional pedagogical training for specialist of physical culture and fitness, in particular, his activity rhythmic structure has not been investigated enough, though not only the sensor-motor and motor aspect [6], but the speech aspect [2] as the principal one is included. This fact predetermines integrative coordination (fig. 2).

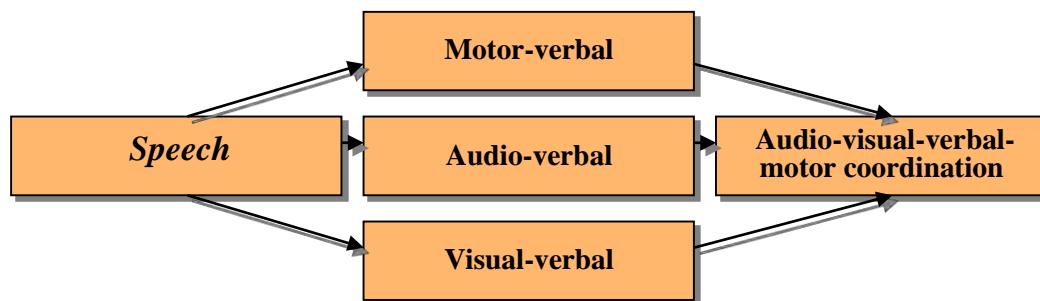
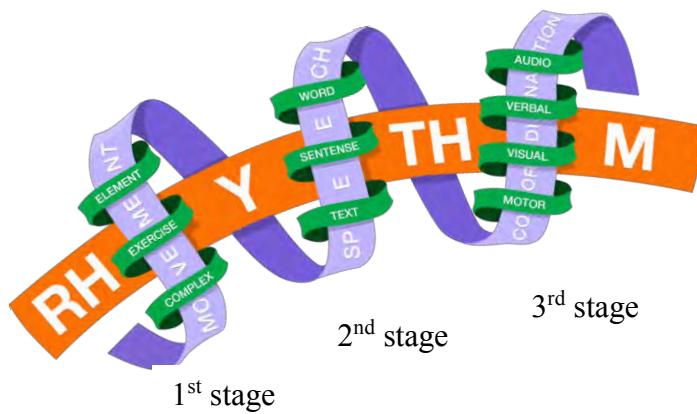


Fig. 2. Rhythmic structural components of professional activity of the physical culture specialist (coordination aspect)

The process of rhythmic structures' formation in professional activity can be presented within the framework in the Conceptual Model (fig. 3).



*Fig. 3. The Conceptual Model formation of rhythmic-structures activity of the specialist of Physical Culture*

To summarize the mentioned above we can make the following conclusion and the further investigation prospects.

#### **Conclusions**

Having studied materials from natural history, psychology, music, cybernetics, synergetics, physiology we have revealed that change of different states occurring in nature as well as in living organisms has wave-like rhythmic character. Physiological basis of rhythm is the dynamic change of excitation and inhibition processes occurring in the central nervous system.

To form rhythmic structure of both motor and speech actions purposefully, we offered to add “Musical and Rhythmic Education” working out to different sports training systems as well as adapting its content to verbal software for educational and training process for teachers and specialists in fitness.

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