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SELECTION OF PLAYING STYLE IN TABLE TENNIS DEPENDING ON THE COMPLEX OF PSYCHOPHYSIOLOGICAL INDICES

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Abstracts

The Research Purpose is typological predisposition and psychomotor indices studying directed on the table tennis playing style formation. **The Methodology of the Research.** 114 male tennis players: 5 Masters of Sports of International Class, 39 Masters of Sports, 38 Candidates for Masters, 32 athletes of the first category have been examined. Typological peculiarities, in particular, strength of nervous system relative to excitation; mobility-inertness of excitation and inhibition, external and internal balance have been studied. **The Research Results.** An offensive strategy is associated with the following typological features: the nervous system of high and average strength (amid the common to all tennis players' weakness of the nervous system) as a reflection of their predominance of excitation in the external balance. Defensive strategy players are characterized by a high resistance to monotony, a greater expression of the nervous system weakness, and a predominance of inhibition according to internal balance. Mixed strategy players are distinguished by a relatively higher (than in defenders) strength of the nervous system, balance of excitation and inhibition processes, and greater mobility of excitation and inhibition processes. The offensive strategy players are characterized by higher motion pace and auto pace as compared to those of mixed and especially defensive strategy play. Defensive strategy players' time of simple and complex visual-motor reaction is significantly higher as compared to those who prefer the offensive strategy.

Defensive and mixed strategy players have got the deferred reactions tend to dominate during the response to moving object, whereas offensive strategy players – premature responses are observed. In order to adequately perceive the current situation and have more time to decide on the proper response action, they have to move further way from the tennis table than the offensive strategy players. **Conclusions:** Study has conducted for examination of typological predispositions and psychomotor indices that condition directed formation of table tennis playing style. It is important direction of training.

Key words: table tennis, nervous system, psychomotor indices, an individual playing style.

Олександр Колумбет, Наталія Максимович. Вибір стилю гри в настільному тенісі залежно від комплексу психофізіологічних показників. Мета роботи – вивчення типологічної схильності та психомоторних показників, які зумовлюють спрямоване формування стилю гри в настільному тенісі. **Методологія дослідження.** Випробовуваними були 114 тенісистів-чоловіків: 5 майстрів спорту міжнародного класу, 39 майстрів спорту, 38 кандидатів у майстри, 32 спортсмени I розряду. Вивчено типологічні особливості: силу нервової системи відносно збудження; рухливість-інертність збудження й гальмування, зовнішній і внутрішній баланс. **Результати.** Атакувальний стиль гри пов'язаний із такими типологічними особливостями: нервовою системою великої та середньої сили (на тлі загальної для всіх тенісистів слабкості нервової системи) як відображенням їх реактивності та переважанням збудження за зовнішнім балансом. Для тенісистів захисного стилю характерні велика стійкість до монотонії, велика вираженість слабкості нервової системи й переважання гальмування за внутрішнім балансом. Для гравців комбінованого стилю гри характерні відносно велика сила нервової системи, урівноваженість процесів збудження та гальмування, велика рухливість процесів збудження й гальмування. У тенісистів атакувального стилю більше, ніж у тенісистів комбінованого та особливо захисного стилів, максимальний темп рухів й автотемп. У гравців захисного стилю час простої та складної зорово-моторної реакції істотно більший, ніж у тих, хто віддає перевагу атакувальному стилю. У гравців захисного та комбінованого стилів при реакціях на рухомий об'єкт переважають реакції, що запізнюються. В атакувальних гравців при

реакціях на рухомий об'єкт переважає передчасне реагування. Щоб адекватно сприймати ситуацію, що складається, і мати більше часу на ухвалення рішення про правильну дію у відповідь, вони вимушені далі, ніж гравці атакуючого стилю, відсовуватися від тенісного стола.

Ключові слова: настільний теніс, типологічні особливості нервової системи, психомоторні показники, індивідуальний стиль гри.

Александр Колумбет, Наталия Максимович. Выбор стиля игры в настольном теннисе в зависимости от комплекса психофизиологических показателей. Цель – изучение типологической предрасположенности и психомоторных показателей, которые обуславливают направленное формирование стиля игры в настольном теннисе. **Методология исследования.** Испытуемыми были 114 теннисистов-мужчин: 5 мастеров спорта международного класса, 39 мастеров спорта, 38 кандидатов в мастера, 32 спортсмена I разряда. Изучены типологические особенности: сила нервной системы относительно возбуждения; подвижность-инертность возбуждения и торможения, внешний и внутренний баланс. **Результаты.** Атакующий стиль игры связан со следующими типологическими особенностями: нервной системой большой и средней силы (на фоне общей для всех теннисистов слабости нервной системы) как отражением их реактивности и преобладанием возбуждения по внешнему балансу. Для теннисистов защитного стиля характерны большая устойчивость к монотонии, большая выраженность слабости нервной системы и преобладание торможения по внутреннему балансу. Для игроков комбинированного стиля игры характерны относительно большая (чем у защитников) сила нервной системы, уравновешенность процессов возбуждения и торможения, большая подвижность процессов возбуждения и торможения. У теннисистов атакующего стиля выше, чем у теннисистов комбинированного и особенно защитного стилей, максимальный темп движений и автотемп. У игроков защитного стиля время простой и сложной зрительно-моторной реакции существенно больше, чем у тех, кто предпочитает атакующий стиль. У игроков защитного и комбинированного стилей при реакциях на движущийся объект преобладают запаздывающие реакции. У атакующих игроков при реакциях на движущийся объект преобладает преждевременное реагирование. Чтобы адекватно воспринимать складывающуюся ситуацию и иметь больше времени на принятие решения о правильном ответном действии, они вынуждены дальше, чем игроки атакующего стиля, отодвигаться от теннисного стола.

Ключевые слова: настольный теннис, типологические особенности нервной системы, психомоторные показатели, индивидуальный стиль игры.

Introduction. The key issue of sports theory is the individualization of the training process, and the learning process, in particular. Large reserves to improve the training process and accelerate the achievement of a high level of skills by athletes are hidden in the development of this issue. Training (and learning) without taking into account individual capabilities, significantly inhibits the growth of sports mastery [10; 26].

One of the scientifically based areas of individualization is the development of an individual style of sports activity in athletes. Until now, these styles have been formed in athletes spontaneously. Styles are formed as a result of modeling oneself upon sports leader or imposing by a coach the style he has used during sports engagement [4; 8; 16].

There are two aspects of styles in table tennis: the study of individual technical skills of players and the study of individual tactics with a sustainable use of ways to perform playing activity. In this work, only the second aspect is considered [3; 12].

These styles should be approached as group (typical) rather than individual ones. That is, their group differentiation is meant rather than individual uniqueness [21].

By attacking style is meant a game that is built primarily on attacking and counter-attacking actions under any playing situations, whereas by defensive style – that based on the actions of a defensive character, with a rare use of single attacking shots. By combined style is meant a game based on attacking character actions with the use of defensive elements aimed at changing the rhythm or pace of the actions.

Formation of an individual style of athlete activity should occur in a targeted manner with due account for the individual peculiarities of athletes. The pride of place in the choice of style of activity goes to typological features of the manifestation of the nervous system properties. They determine the athlete's desire to carry out activity in a certain way and act as the makings of capacities and qualities (physical, volitional), with account for which a style of activity should be formed [11].

From the angle of pedagogics, any study of the regulations of activity style formation in athletes should be based on psychological data about their individual peculiarities.

The authors are showed that athletes with a strong nervous system in most cases gain points due to strength of shot, whereas those with a weak nervous system due to high accuracy [14; 15; 24]. Unfortunately, the authors has not studied the combined style of play, which is peculiar for many tennis players.

The level of modern table tennis development is so high that it requires a thorough scientific substantiation of the principle of in-depth individualization. Individual differences are diverse, but the main ones are on-going and easily changing features, whereas permanent – typological peculiarities of the nervous system properties, conditioning, in particular, the style of activity of athletes.

The objective of the study was to examine typological predispositions and psychomotor indices that condition directed formation of playing style in table tennis.

Material and Methods. The subjects were 114 male tennis players: 5 masters of sports of international class, 39 masters of sports, 38 candidates for masters, 32 athletes of the first category.

Typological peculiarities of the nervous system basic properties were studied by means of voluntary motor methods [6; 14]. Typological peculiarities were studied in tennis players of various styles of play: strength of nervous system relative to excitation; mobility-inertness of excitation and inhibition, external and internal balance.

Simple and choice responses were studied by means of electronic stopwatch. While determining a simple response, it was necessary in 10 attempts to respond to the white signal lighting by releasing the button. In order to determine the choice reaction in 10 attempts, it was necessary to respond to the white signal, whereas in 7, according to a certain program, it was forbidden to respond to the lighting of the red and green signals. The average of three measurements was calculated.

The response to a moving object (RMO) was measured by means of electric stopwatch (*type PB-53 III*): the experimenter turned on the electric stopwatch, and the subject had to stop the electric stopwatch pointer after 0.8 s by releasing the button. The subject was given 10 attempts, and the average RMO value was calculated. In addition, a response sign (premature, accurate, delayed) was taken into account.

Maximum motion frequency was measured by means of «*Tepping-1*» device. The subjects pressed on the key as quickly as possible within 30 sec. Data were recorded every 5 s by means of electronic counter. The subjects were tested three times, after which the average values for every 5 s and during 30 s were calculated.

Autopace was studied by means of «*Fiziolog-M*» device. The subject was supposed to extinguish three-color light bulbs lighting in different places on the block as quickly as possible by pressing one of three buttons. The response action automatically caused the appearance of a new signal.

In this regard, typological peculiarities were studied in tennis players of various playing styles: strength of nervous system relative to excitation; mobility-inertness of excitation and inhibition; «external» and «internal» balance.

Results. Based on the evaluation of three competent experts, interviews of tennis players and observations of the playing style during competitions, athletes were assigned to representatives of one of the three playing styles: attacking (38 persons), defensive (36 persons) and combined (40 persons).

Strength of Nervous System and Playing Style. Against the background of a general tendency to weakness of the nervous system, which provides fast action, it can be noted that in tennis players the nervous system of a high and average strength is somewhat more common in those of the attacking style than the defensive one (table 1). In athletes of the combined style of play the nervous system of high and average strength tends to dominate (mainly at the expense of the latter). For players of a defensive style, a weak nervous system is more peculiar (86,7 %).

Mobility-Inertness of the Nervous Processes and Playing Styles. A comparison of mobility-inertness of excitation and inhibition showed that in attacking style tennis players inertness of excitation was observed more often than in those of defensive playing style (table 1).

External Balance and Playing Styles. Among tennis players of the attacking playing style, a greater percentage of individuals with a predominance of excitation were noted as compared to tennis players of a defensive style (table 1).

Internal Balance and Playing Styles. Differences in the balance between internal excitation and inhibition were revealed in athletes of different playing styles. A great number of athletes (53,3 %) with inhibition predominance in this balance were observed among those of defensive playing style.

Visual-Motor Responses and Playing Styles. A comparison of the average time of a simple visual-motor response in tennis players of different playing styles suggests that there are no significant differences in this index ($p > 0,05$; table 2).

Feebly marked tendency to an increase in the time of a simple visual-motor response from attacking style to a defensive one was established.

Table 1

Characteristics of Typological Peculiarities of Nervous System Properties

Major Nervous System Properties		Attacking	Combined	Defensive
Strength of nervous processes	high	9,6	-	-
	average	12,4	40,1	21,6
	low	78,3	60,1	78,2
Mobility of nervous processes	excitations	37,8	50,1	52,3
	inhibitions	57,2	60,1	52,3
Balance between external excitation and inhibition	excitation dominance	19,9	20,2	8,8
	balance	56,4	60,1	82,5
	inhibition dominance	23,5	20,1	8,6
Balance between internal excitation and inhibition	excitation dominance	26,8	39,9	8,8
	balance	46,1	40,1	-
	inhibition dominance	26,7	20,1	91,1

Comparison of the *time of complex visual-motor response* in groups allows to draw similar conclusions. The differences between the mean group data are statistically insignificant ($p > 0,05$).

Table 2

Time of Simple and Complex Visual-Motor Response in Tennis Players of Different Playing Styles (ms)

Playing Styles	n	Time of Response				Central Delay	
		Simple		Complex		M±m	t
		M±m	t	M±m	t		
A	38	154,0±16,2	3,2	202,9±19,4	4,0	48,5±8,1	3,0
C	36	156,2±18,1	4,8	205,6±30,4	8,1	49,4±10,2	5,1
D	40	159,9±14,2	3,7	220,0±25,9	11,9	60,1±10,1	4,7

Note. A – attacking playing style; C – combined playing style; D – defensive playing style.

More distinct differences have been obtained in the time of the «central delay»: the players of the defensive style are significantly inferior in this index to those of the attacking and combined style.

Table 3

Accuracy and Quality of RMO in Tennis Players of Different Playing Styles

	n	Error of Response		Premature	Proper	Delayed
		M±m	t			
A	22	17,9±2,3	0,5	50	22	28
C	16	13,2±2,1	0,4	28	29	42
D	15	21,9±3,2	0,4	25	18	57

Note. A – attacking playing style; C – combined playing style; D – defensive playing style.

Response to a Moving Object (RMO). The accuracy of response to a moving object (Table 3) varies in tennis players of different playing styles. It is the highest (response error is lower) in players of the combined style. The lowest accuracy of response to a moving object was revealed in players of a defensive style (response error is the highest). Players of attacking style occupy an intermediate position. In the attacking style players, the error of response is most often associated with a premature response, whereas in those of the combined and defensive style - with a delayed one.

Motor Pace and Autopace. It has been established that the motor pace of attacking style players is higher than that of the players of the combined and defensive style (table 4). The differences between the groups in the maximum pace are statistically insignificant ($p > 0,01$). In terms of auto-pace, statistically significant differences were observed between athletes of the attacking style of play and those of the defensive and combined style ($p < 0,05$). According to autopace indices, statistically significant differences were noted between the attacking style players and those of the defensive and combined playing style ($p < 0,05$).

Table 4

Motor Pace and Autopace in Players of Different Playing Styles

Playing Styles	Motor Pace				Autopace	
	30 s		5 s		60 s	
	M±m	t	M±m	t	M±m	t
A	208,2±24,3	12,9	34,7±4,1	1,8	75,8±7,1	2,5
C	188,4±19,4	8,7	31,4±3,2	1,4	66,9±6,2	2,8
D	180,6±18,6	8,4	30,1±3,1	1,4	65,4±4,3	1,6

Note. A – attacking playing style; C – combined playing style; D – defensive playing style.

The association between playing styles and a complex of typological features was studied. Methods have been developed for calculating the values of typological complexes, which condition the manifestation of either quickness, or resistance to monotony, or patience. The value of this complex characterizes the trend in the group of examined sample. We assumed that in groups with different playing styles, the values of different typological complexes would be different. The tennis players of the attacking style would have more expressed typological complex of speed and determination, whereas those of defensive style – that of patience and resistance to monotony.

In terms of the ability to resist monotony during competitions and training sessions, tennis players of three styles according to the expression of a monotonophile complex have been arranged as follows. More resistant to monotony are those players who constantly face the routine of work, i.e., defenders (the value of a typological complex is +240 conventional units) whose play is built on the desire for a prolonged playing out point. This is not the case with players of the combined style. Accordingly, their values of typological complexes of monotonophilia are the lowest (+59,2).

The values of typological complex of monotony resistance in attacking style players are higher than those in combined style players, but lower than in players of defensive style. This is due to the fact that they use a small number of technical skills in the game, which, however, are brought to a high degree of automatism, perfection and efficiency. We have also calculated the values of the typological complex, which determines the fast action. It includes: a weak nervous system, mobility of nervous processes and the predominance of excitation in the external balance.

Discussion. Speed qualities are recognized as the key and differentiating styles of play (according to the survey of coaches). We gave the main attention to studying the following indices of fast action: simple and complex visual-motor response, RMO, maximum pace and autopace [2; 19].

Excitation inertness is more often observed in attacking style players than in those of the defensive style. This coincides with the data available in the literature, which characterize one or another style from the point of view of mobility-inertness of excitation [23].

A large number of athletes (53,3 %) with predominance of inhibition in the balance between internal excitation and inhibition were found among defenders. This may mean low level of motor activity of defensive style tennis players, which is unlikely. Another explanation may be the following: when internal inhibition prevails, proper voluntary relaxation of muscles is observed - a condition of an easy defensive play (the prevalence of excitation in this type of balance is often encountered in people with muscular tension, and this leads to rigid ball reception and, as a result, to an inaccurate play). At the same time, predominance of excitation in the internal balance provides a high work capacity, and from this point of view one would expect a high percentage of tennis players with this typological feature just among defenders [5; 17].

It has been established that speed of perception and processing of visual signals of defensive style players is lower than that of players of other styles (there is no significant difference between players of attacking and combined style in the time of the «central delay»). Defensive style tennis players tend to stay further away from the table than those of attacking style. Among other reasons, this gives them some time to perceive the rapid flight of the ball and make a decision about the proper response action [7].

Among athletes of the attacking style, there are more those with a strong nervous system than among athletes of the defensive style [13; 25]. However, inertness in tennis players was more pronounced while using a defensive playing style. Inertness is included in the typological complex of patience, which is peculiar for players of a defensive style [1; 18].

Among tennis players of the combined style there are many those with the mobility of nervous processes (especially inhibition). This style is associated with a flexible construction of a tactical pattern of play, with fast switching from one playing action to another [1; 19].

The significance of typological peculiarities of external balance manifestation may be assessed in combination with other typological features only [22]. Based on the data of authors, determination in situations that are not associated with fear is characterized by a complex of typological features: mobility of excitation, predominance of external and internal excitation [9]. The typological complex of determination is positive in athletes of the attacking style (+6,1 %) and negative in players of the defensive style (-108,5 %). This indicates their indetermination.

The play of defenders is associated with monotony. We have traced the expression of the typological complex, which is related to resistance to monotony. Monotonophilicity (resistance to monotony) is characterized by the following complex: weak nervous system, inertness of nervous processes, predominance of external inhibition over external excitation and internal excitation over internal inhibition [18].

Typological peculiarities of the manifestation of the nervous system properties have a complex impact on the psychophysiological manifestations – either reinforcing the influence of each other, or preventing the impact of other nervous system properties [11, 16, 25].

Typological complex of patience is formed by strong nervous system, inertness of excitation, predominance of excitation in the internal balance and inhibition in the external balance [20]. Tennis players of all styles have negative values of this typological complex, they have little patience.

Conclusions. Attacking style is associated with the following typological peculiarities: nervous system of high and average strength (in the face of nervous system weakness common to all tennis players) as the reflection of their reactivity and excitation predominance in external balance.

High resistance to monotony, a greater expression of the nervous system weakness and predominance of inhibition in internal balance are typical for defensive style players. Their typological peculiarities create a prerequisite for a tactically more diverse play, but force them to play without risk, on the break and far from the table (to have more time to perceive the ball flying at high speed).

Relatively high (as compared to defenders) strength of the nervous system, balance of the processes of excitation and inhibition according to the 1st and 2nd tests, high mobility of excitation and inhibition processes are characteristic for combined style players. The balance and mobility of nerve processes allow players of this style in an RMO to react timely and accurately to a flying ball, to adequately perceive and properly switch from one playing situation to another.

Attacking style players are characterized by higher maximal pace of motions and autopace as compared to those of combined and especially defensive style. Time of simple and complex visual-motor response is significantly higher in defensive style players as compared to those, who prefer the attacking style of play. During RMO the delayed responses tend to prevail in players of defensive and combined style.

Premature responses tend to prevail in attacking style players during RMO. Therefore, in order to adequately perceive the current situation and have more time to decide on the proper response action, they have to move further away from the tennis table than the attacking style players.

Conflict of Interest. The authors declare that there is no conflict of interests.

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