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Characteristic of instrumental movements – eye hand coordination in sports

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Abstract

The purpose of this study consists in analyzing sports people from the point of view of eye-hand coordination. The computerized test TUD (Dynamic Tracking), developed by RQ Plus, is conceived as a dynamic model obtained through the constant or unsteady movement of a target in an delimited space. A number of 127 athletes participated at the study – practitioners of some sports in which the relation between the athletes implies direct contact (handball, basketball, karate) or no contact (gymnastics, dance, athletics, and swimming). Using t test, significant differences between subjects were identified, statistically-wise ($p < 0,05$), concerning eye-hand coordination.
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Keywords: eye-hand coordination; sensory-motor coordination; instrumental movements; upper limb coordination ; appreciation of speed and distance.

1. Introduction

Eye-hand coordination is a complex psychomotor skill with an essential role in adaptation, which involves synergistic action of sensory functions (exteroceptive and interoceptive) and motor function, resulting in providing informational and energy parameters of the movement. Specialized literature (M. Aniţei, 2007) indicates the importance of eye-hand coordination as an indicator that allows a correct evaluation of instrumental movements (those movements associated with device manipulation, tools, machines, movements that can be done at superior precision indices, dexterity and timing).

Coordinated movements represent a distinct category of instrumental movements, which give to the subject the possibility to economize effort, motor action, in predictable situations (stereotypical) and

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unpredictable (of adjustment). The level of movement coordination is influenced by the level of knowledge of the motor skills, the level of automation of the same, as well as by the disruptive factors or the desultory characteristics of the environment. The quality of the coordination is affected by the position of the subject – the precision of the manipulation movements is maximum for the objects set in front and under the level of the shoulders. The coordination difficulties manifest thorough: temporal discrepancies between processing the information and executing the motor act, errors of non-synchronization of individual movements, order errors (inversions or substitutions of movements) or commutative errors (persevering with the anterior movement, interferences between movements).

2. Organization of the research

2.1. Scope

The investigation of the eye-hand coordination (under slow speed and fast speed conditions) both for male athletes and female athletes – practitioners of some sports in which the report between the athletes is based on direct contact (handball, basketball, karate) or no contact (gymnastics, dance, athletics, swimming).

2.2. Subjects

A number of 127 athletes participated at the study – practitioners of some sports in which the relation between the athletes implies direct contact (handball, basketball, karate) and practitioners of some sports without any direct contact with the opponent – gymnastics, dance, athletics (jumps, running), swimming.

2.3. Methods

Observation, conversation, test – Dynamic Tracking TUD Test, within PSISELTEVA tests, elaborated by RQ Plus.
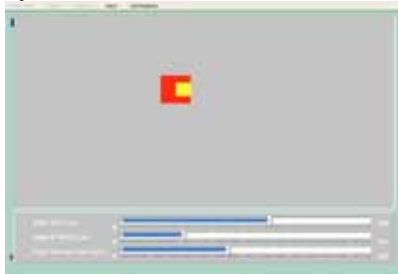

Fig. 1. The computerized test TUD

2.3.1. Description and development

The test has a determined time and is conceived as a dynamic model obtained through the constant or unsteady movement of a target in a delimited space. The signal-stimulus target – under the shape of a yellow square, moves in the action field (the monitor's screen) on different trajectories (left/ right, up/ down). The purpose of the subject is to follow the signal-stimulus target by maintaining this one in a limited space under the shape of a red square named collimator. Response devices: – two levers (left - right) equipped with buttons. The movement of the collimator on an up/ down direction is automatically performed, through programming, at the same time with the target. In three pre-established moments of

the test, the target suddenly changes position through a fast jump movement and after that, it re-enters movement rhythm prior to the jump. The request is to solve the task on a slow speed basis (speed 1) and on a fast speed basis (speed 2). The result presentation bar offers information with respect to the total duration of the test, the maintenance duration of the collimator overlapped to the target, the maintenance duration of the collimator in the small error area. The action field is delimited, depending on the position of the target in each point of the movement, in the small error area (the action field close to the target) and the error area (the action field which is outside the small error area).

2.3.2. Results of the test

- Time – the total duration of the test (measured in seconds);
- Target time 1 – the time (measured in seconds) in which the target was maintained in the collimator, for speed 1 (slow speed conditions);
- Target time 2 – the time (measured in seconds) in which the target was maintained in the collimator, for speed 2 (fast speed conditions).

3. Results

Preliminary data analysis (box-plot chart) has emphasized the fact that in the case of target time 1 and target time 2, there were no excessive values – marginal and extreme. We present for example box-plot for male athletes.
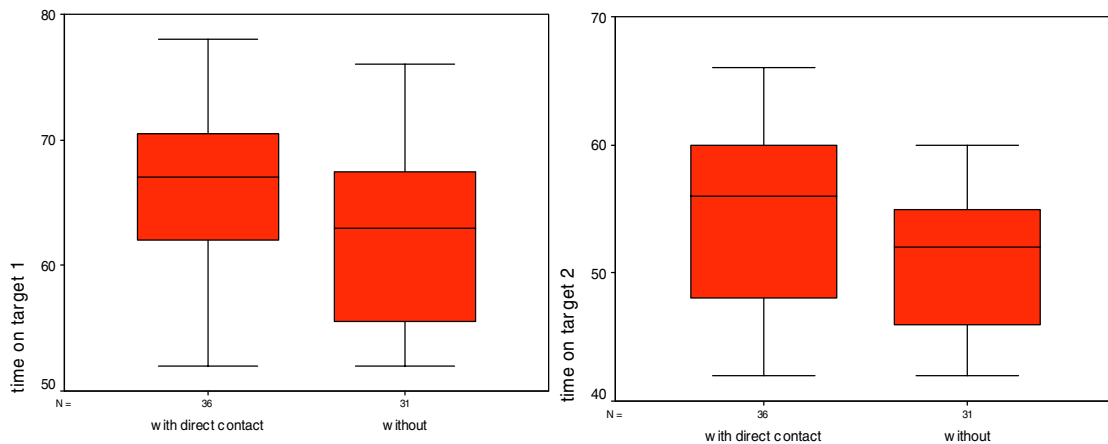

Fig. 2. (a) Extreme values – target time 1 (male athletes); (b) Extreme values – target time 2 (male athletes)

By means of t test for independent samples we have verified if there are significant differences under a statistical report, both for male athletes and female athletes, between the two groups of athletes (those who practice sports in which the contact with the opponent is direct – handball, basketball, karate and those who practice sports without any direct contact with the opponent – gymnastics, dance, athletics, swimming). The two groups have been compared regarding the analyzed dependent variables means – target time 1 and target time 2. This test is specific to intergroup designs (between groups).

The following conditions for the application of t test are fulfilled:

- Group independence – each subject is a part of a single group, and these groups are independent;
- The dependent variable is quantitative, measured on an interval scale;
- The dependent variable is normally distributed;

Homogeneity of variances – groups must be a part of population with equal variations. For the testing of this condition one has used the Levene test (with the help of SPSS program). Due to the fact that the Levene test results are insignificant ($p>0,05$), the variances are equal.

Table 1. Results for the group „With direct contact" – group „Without direct contact" (target time 1, target time 2 – male athletes)

Variables		N	m	s	t	df	p	d	Trust-interval	
									inferior	superior
	Group M				2,33	65	.022	0.58	0.58	7.32
target time 1	With direct contact	36	66.1	6.86						
	Without direct contact	31	62.1	6.94						
					2.20	65	.022	0.58	0.33	6.70
target time 2	With direct contact	36	54.8	7.27						
	Without direct contact	31	51.2	5.49						

The analysis of the results obtained for target time 1 and target time 2 for male athletes, indicated in table number 1, emphasize:

- the mean of the target time 1 (the time in which the target was maintained in the collimator, for speed 1) and the mean of the target time 2 (the time in which the target was maintained in the collimator, for speed 2) in subjects from the „With direct contact" group (With direct contact mean1 = 66,11 and With direct contact mean2 = 54,81) is significantly greater ($p < 0.05$) than that of the subjects in the "Without direct contact" group (Without direct contact mean1 = 62,16 and Without direct contact mean2 = 51,29).
- the effect size index ($d = 0,58$, respectively $d = 0,55$) shows an important difference between the performance obtained at TUD by the athletes who practice sports in which the contact with the opponent is direct – handball, basketball, karate and the athletes who practice sports without direct contact with the opponent – gymnastics, dance, athletics, swimming.
- the trust interval (95%) for the difference between means is comprised between the inferior value of 0,58 and the superior value of 7,32 for target time 1 and between the inferior value of 0,33 and the superiour value of 6,70 for target time 2.

Table 2. Results for the group „With direct contact" – group „Without direct contact" (target time 1, target time 2 - female athletes)

Variables		N	m	s	t	df	p	d	Trust-interval	
									inferior	superior
	Group F				2.47	58	0.16	0.64	0.98	9.22
target time 1	With direct contact	30	62.3	7.06						
	Without direct contact	30	57.2	8.79						
					2.09	58	.040	0.53	0.17	7.29
target time 2	With direct contact	30	47.8	6.63						
	Without direct contact	30	44.1	7.14						

The analysis of the results obtained for target time 1 and target time 2 for female athletes, indicated in table number 2, emphasize:

- the mean of the target time 1 (the time in which the target was maintained in the collimator, for speed 1) and the mean of the target time 2 (the time in which the target was maintained in the collimator, for speed 2), in subjects from the „With direct contact" group (With direct contact mean1 = 62,33 and With direct contact mean2 = 47,83) is significantly greater ($p < 0.05$) than that of the subjects in the "Without direct contact" group (Without direct contact mean1 = 57,23 and Without direct contact mean2 = 44,10).
- the effect size index (d = 0,64, respectively d = 0,53) shows an important difference between the performance obtained at TUD by the athletes who practice sports in which the contact with the opponent is direct – handball, basketball, karate and the athletes who practice sports without direct contact with the opponent – gymnastics, dance, athletics, swimming.
- the trust interval (95%) for the difference between means is comprised between the inferior value of 0,98 and the superior value of 9,22 for target time 1 and between the inferiour value of 0,17 and the superiour value of 7,29 for target time 2.

4. Conclusions

The analysis and statistical processing of the data highlights significant differences under a static report for target time 1 and target time 2 – the time (measured in seconds) in which the target was maintained in the collimator, for speed 1 and speed 2, between the two samples of athletes – practitioners of some sports in which the contact with the opponent is direct – handball, basketball, karate and practitioners of some sports without any direct contact with the opponent – gymnastics, dance, athletics (jumps, running), swimming. The results obtained show that, both for male athletes and female, the subjects who practice sports in which the report between the athletes is with direct contact – handball, basketball, karate, have a significantly better eye-hand coordination (under slow speed and fast speed conditions) than the subjects that practice sports without direct contact with the opponent – gymnastics, dance, athletics (jumps, running), swimming.

Our research has been limited by the psycho-physical condition (tiredness, emotional-motivational factors) of the participants during testing, which can determine variations of the motor answers. Another limitation is constituted by the samples of athletes. The situation could be different if the samples would be constituted, for example, from athletes practicing football (with direct contact with the opponent) and athletes practicing volleyball, tennis, shooting (without any direct contact with the opponent). Observation and dialogue as research methods, suport the value of our research, which is based on the study of eye-hand coordination, the differences observed being reported to the analyzed sports. Systematic sports practice where the contact with the opponent is direct one represents an efficient way to develop skills directly involved in increasing the efficiency both in sports as well as in general, in socio-professional activity, such as: eye-hand coordination (both slow speed as well as fast speed), appreciation of speed, distance, and upper limb coordination.

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