

# PRECISION OF MANIPULATION MOVEMENTS OF 7-15 - YEAR - OLD CHILDREN IN CONTINUOUS AND CROSS-SECTION INVESTIGATION

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## INTRODUCTION

Movement coordination is defined as the joint action of physiological mechanisms which ensure the performance of a realizable definite movement task according to the movement programme. The practicability of the task results from strength, speed and endurance abilities of a system while the concreteness results from the degree of mastering of the movement habit, and thus, the specified level of man's training and development. At the moment, competitive sport has at its disposal an **enormous** knowledge concerning methods of improvement and evaluation of strength, speed and endurance. Methods of teaching and evaluation of the sports technique are developed and improved. Possibilities of raising sports results to a higher level are sought in the study of the steering processes in the **neuro-muscular** system as well as in the possibility of their evaluation. If the steering in the neuro-muscular system, and thus, the neuro-muscular **coordination** is to be decisive in the evaluation of the movement coordination, one should find such movement tasks which can be performed without the use of maximum strength, speed or endurance abilities. Moreover, such a task **should** be easy enough so the process of learning would not influence the valuation (Newell, 1989). In such case the performance of a given movement programme will be the result of the process taking place in the neuro-muscular system.

It has been assumed that accuracy and speed of the manipulation movements as well as the unchangingness of the movement when it is accompanied by external disturbances can be the criteria of the evaluation of the steering processes, and thus, movement coordination. The criteria of speed and accuracy are of opposing character. There are reasons to believe that superior centres of the central **nervous** system make decisions which criterion is to decide about the way of performing a movement (Bernstein, 1967).

Considering the fact of an early specialization it is important that the evaluation of the process of movement steering of children is possible. The results of the investigations show that on one hand movement precision is conditioned genetically and on the other hand body growth is accompanied by the change of the response of the nervous system, and at the same time, changes of the time of the conducting of the functional potentials which is due to the extensions of the peripheral trails take place on the spinal level (Walsh, 1964).

The aim of the paper was to **find the** dependencies between the criteria of evaluation of the manipulation movement as well as an attempt to evaluate movement coordination of the 7-15- year-old children and the ascertainment of growth correctness.

## METHODOLOGY

The evaluation of the steering process on the basis of the criteria of accuracy, speed and unchangingness of the movement has been conducted on an electronic indicator of error of a programmed movement. Principles of movement steering formulated by Bernstein (1967) have been **used, while** constructing this device. The task of the examined was to lead the deflection indicator of the slider on the demonstration trajectory. Electromagnets which caused disturbances such as stopping, accelerating and moving aside were placed under **the** control desk with demonstration trajectory.

Manipulation movement was evaluated on the basis of data such as the time of movement, the time of error (the total time when the deflection indicator of the slider was beyond the demonstration trajectory), the number of errors and the error index (the sum of areas indicated by deflection indicator of the slider beyond the demonstration trajectory) obtained from the set meters (Rutkowska-Kucharska, 1986).

The subject performed four different movement tasks. In the first task (1) movement accuracy was evaluated. The speed was up to the examined. In the second task (2) changeable external disturbances were introduced. Time was limited in the next task (3) and the last task (4) was to be performed accurate] and fast, and was accompanied by disturbances of the movement of the slider caused by the electromagnets. The examined group consisted of 7-15-year-old primary school pupils. Each year the same children were examined (n=240).

## RESULTS AND DISCUSSION

The comparison of the four tasks does not give an unmistakable answer whether the change of conditions of the movement changes the precision of manipulation movements. Yet, it can be stated that the significance of differences among the compared tasks increases with age. Only in case of the youngest and 8-year-old girls it can be stated that the precision of manipulation movements gets worse to the same degree both when the time of movement is limited and when changeable external disturbances are introduced (tab. 1).

Table 1. The significance of differences of movement precision in tasks evaluated considering accuracy, speed and inurement to external disturbances.

Age	Compared tasks	Time of error	Number of error	Error index
7.5	1 - 2	2.285*	2.440*	2.224*
	1 - 3	1.132	2.375*	1.576
	1 - 4	2.825*	4.869*	3.137*
	2 - 3	1.322	0.327	0.884
	2 - 4	0.018	2.038*	0.342
	3 - 4	1.671	2.789*	1.455
8.5	1 - 2	1.708	1.954	1.726
	1 - 3	1.198	3.665*	1.430
	1 - 4	2.947*	5.786*	2.998*
	2 - 3	0.920	1.041	0.684
	2 - 4	0.704	2.826*	0.805
	3 - 4	2.332*	2.557*	1.999
9.5	1 - 2	2.059*	2.587*	2.101*
	1 - 3	2.578*	3.900*	2.776*
	1 - 4	4.917*	6.071*	5.426*
	2 - 3	0.069	2.008*	0.620
	2 - 4	1.771	3.869*	2.562*
	3 - 4	2.113*	2.015*	1.835
10.5	1 - 2	1.159	2.268*	0.978
	1 - 3	2.389*	5.888*	2.836*
	1 - 4	5.019*	8.410*	5.109*
	2 - 3	1.165	3.686*	1.743
	2 - 4	3.978*	6.485*	4.108*
	3 - 4	3.280*	3.310*	2.769*

\* statistically significant at 5% level of confidence

Movement coordination was evaluated on the basis of the error index. This parameter depends on the number of errors committed by the examined and the time when the slider is beyond the path. The comparison of results obtained in the succeeding years of the experiment shows a significant inter-individual differentiation of the precision of manipulation movements of the 9.5-10.5-year-old girls and 10.5-11.5-year-old boys. However, the analysis of the error index of the whole group shows a significant improvement of the movement precision of the 9-year-old children. A relative stabilization of this feature follows later (fig 1).

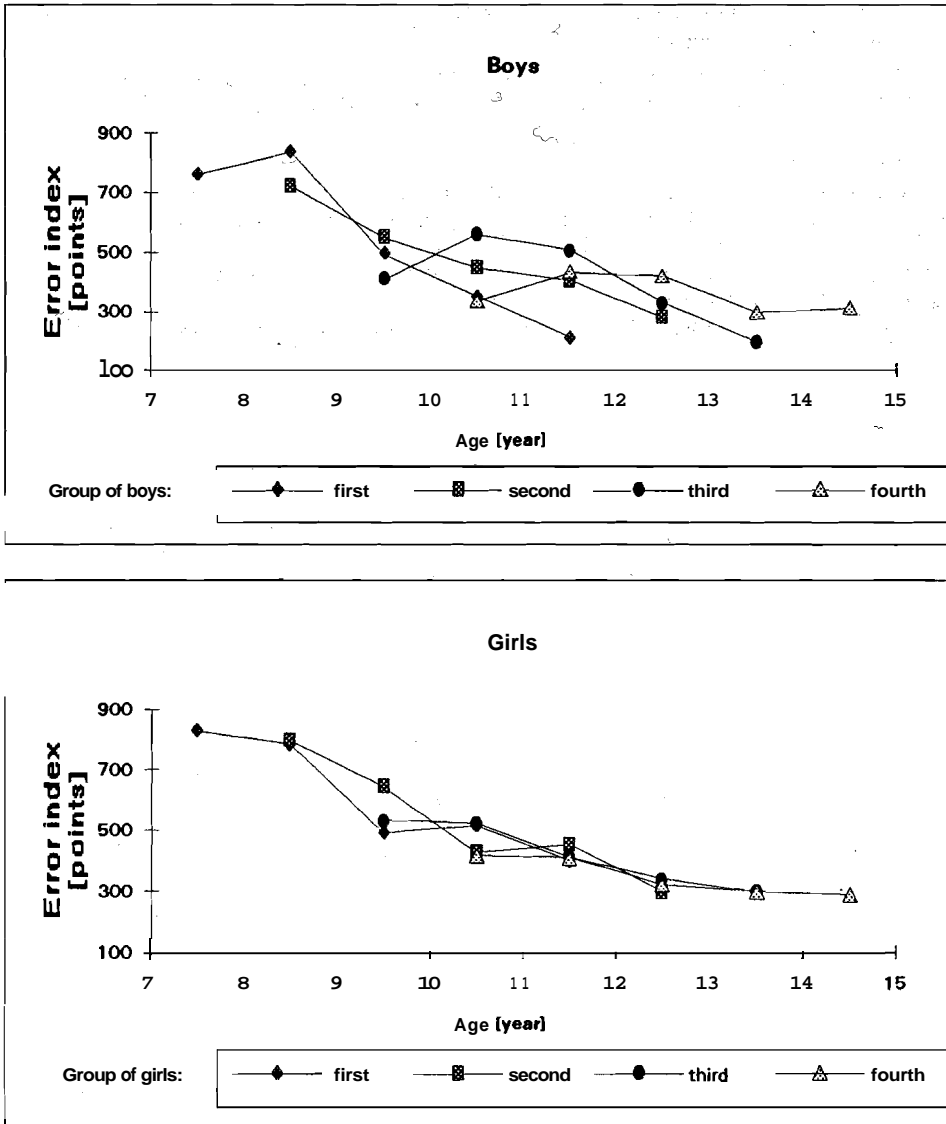


Fig. 1. Values of the error index obtained by four groups of children in longitudinal study

On the basis of the physiological analysis it can be assumed that each movement task required the initiation of a different steering loop in the neuro-muscular system. The lack of clear dependencies between the parameters of the test achieved by the 7-8-year

old children in various experimental conditions may probably be due to the formation of the steering processes in the neuro-muscular system under the influence of external stimuli. Very high values of the error index **prove** that children **at** that age have problems with the execution of precise movements.

#### CONCLUSIONS

A significant improvement of movement **precision** can be found among the 9-year-old children, yet, great differences can be noticed among the examined. This may result from the intensive processes of the improvement of the steering in the **neuro-muscular** system which get ahead of the period of huge abilities of children as far as speed and agility are concerned.

**This** knowledge can be used in the competitive sport, especially in technical events where the formation of complex habits takes place mainly on information basis.

#### REFERENCES:

- Bemstein N. (1967) The coordination and regulation of movements. **Pergamon** Press, Oxford.  
Newell K.M., van **Emmerik** R.E.A. (1989) The acquisition of coordination: preliminary analysis of learning to write. *Human movement science* **8**, pp.17-32.  
Rutkowska-Kucharska A. (1986) The level of coordination of the tested on the 10 years old girls, *Biology of sports*, Vol. 4, No 2, pp. 141-146.  
Walsh **E.G.** (1966) *Physiology of the nervous system*. **Longmans, Green** nad Co Ltd, London.