Bulletin of the *Transilvania* University of Braşov
Series IX: Sciences of Human Kinetics • Vol. 11 (60) No. 1 - 2018

STUDY REGARDING THE ROLE OF THE SIMULATOR AND MODERN TECHNIQUES ON ERROR SCREENING AND CORRECTION OF SOME SPECIFIC MOVES ON PERFORMANCE SWIMMERS

Silviu ȘALGĂU[1]

Abstract: *Swimming is one of the performance sports with a high effort demand for the youth. To get superior performances, the swimmer or the sportsman, in general, needs to act in favor of development of all motion-related qualities involved into the aquisition of that said performance.*
The studies and researches confirmed that there is no motion without a force, and an improper education of this attribute makes even impossible the formation and consolidation of the motrical behaviours. The computer-aided simulator grants the possibility to highlight and measure the neuromuscular processes, giving access to an objective, instant information. This kind of information permits corrections of the technique in real time, during the motion, and corrections for the motion parameters during the motric act or when transitioning from one kind of motion to another (in the case of cyclic sports). The use of the simulator is augmented by other modern techniques (video in-water recordings, both front and profile, and software programs, namely MaxTRAQ).
The study is focused largely on the analysis of training the performance swimmers, having a dominant attraction to the crawl swimming procedure.

Key words: *sport performance, simulator, crawl, technique, training, motion.*

1. Introduction

The computer-aided simulator offers the possibility for emphasizing and measuring the neuromuscular processes giving access to the objective, instantaneous information [12]. This sort of information allows fixing the technique in real time and corrections for the values of movement parameters during the motion

[1] "Vasile Alecsandri" University of Bacau, Faculty of Sports, Health and Movement Sciences, Department of Physical Therapy and Occupational Therapy.

act or during the transition from one movement to another.

In the modern theory of sport training, assuring superior indices for physical training becomes a basic condition for obtaining the necessary efficacy and, at the same time, for its [1, 2], [7], [10].

The complex sphere of physical training, along with its importance during the training imposed the splitting of this component into multi-purpose physical training and specific physical training [3].

The experiment behind this paper tried to discover new training methods for the swimmers, using new, "young" devices.

2. Objectives

We've started this study to discover if the condition simulator "ERGOSIM" truly improves the performances of a sportsmen group in contrast with another which didn't use it during the training.

To deeply study the influence of the training methods and the simulator, this paper aims for the following:

1. Establishing a specific schedule and training for the biological and biometrical tests.
2. Coalescing the observations acquired from training and preparations.
3. Making some proposals regarding the testing methodology change and completions for the training methodology.

This paper aims to validate the hypothesis which states that *the usage of the simulator and modern recording techniques can form efficient methods for detecting the execution errors and correcting the specific movements during the performance swimmers' training sessions*.

3. Material and Methods

Our research was conducted on two swimmers groups, students at "Emil Racoviţă" Sport College from Bucharest, those swimmers being components of national juniors' league, during the competitional year 2017. The experimental group had 12 sportsment which trained also on the simulator and the control group had 8 which did standard training sessions.

The research methods used [4] were the reference method, the observational method, the experimental method and the mathematical analysis method.

The "ERGOSIM" system was used in similar conditions to those natural, so as the distance/duration ratio to be as closely as in watery conditions.

Also, we used the releasing method, having as the purpose the training on the simulator on which the water resistance is decreased.

To improve the speed attribute, we also used a scenario in which the water resistance was kept constant, and the training was supplemented with engine action.

The operating time was lowered to a maximum 10 second, for each sportsman, so we could apply on the simulator different types of pool training in which the variations between intensity, training timings and break timings could be achieved.

Subject list Table 1

Nr. crt.	Name	Age	Spec	Group
1	B. D.	15	Sprint	**Experim.**
2	C. A.	16	Fond	
3	C. M.	15	Medii	
4	E. A.	15	Fond	
5	F. C.	16	Medii	
6	F. A.	15	Sprint	
7	G. A.	16	Medii	
8	I. M.	15	Sprint	
9	L. C.	16	Medii	
10	I. Ş.	16	Sprint	**Control**
11	T. F.	16	Sprint	
12	A. C.	15	Fond	
13	Ş. A.	15	Medii	
14	P. A.	15	Medii	
15	I. L.	15	Medii	
16	R. G.	15	Fond	
17	T. A.	16	Sprint	

The engine-based simulator trainings were done as closely as those in swimming pool:

- For swimmers specialised on speed: 50m, 100m or 2x50m, with 10 seconds break, but with 5-10 minutes break between series.
- for swimmers specialised on resistance: 4x50m, 2x100m, with 10 seconds breaks and 5-10minutes breaks between series.

The experiment group did on average 4 engine trainings per week. The control group didn't train on simulator at all.

Before starting the differentiated training, both sportsmen groups were initially tested for force-speed, to notice their level at that moment. At the same time, with a recording camera we've extracted the technique biases for each sportsman in the experimental group.

The second test for force-speed was done at the end of training phase, before the Romanian International Championship (RIC) in covered pools.

After the championship, the newly training year started with another force-speed test, just to notice in what measure the sportsmen kept their gaining.

4. Results and Discussions

The required research data were gathered from multiple sources.

First, the simulator plots were used, which had shown the level of force and its control.

Second, the video recording data of tests, to check the correctness level of movement techniques.

Third, some specific tests were done, more explicitly in-water testing, to observe the evolution/involution of the sportsmen performance.

Also, for these tests some video recording were done to later estimate the technique at maximal specific effort.

The force-speed tests helped us to establish for each sportsman his level at these parameters and were conducted based on the following methodology, suggested by specialists:

- 10 repeats batches are done;
- The first batch charge is approximately 10 (the simulator does not allow a less than 1 charge);
- For each batch the charge is increased on steps of 25 conventional units;
- The device is started after the first 2-3 moves, when the sportsman is supposed to reach the maximum speed;
- Each force, speed and power params are recorded;
- The test is stopped when the power diminished 2 times in a row;
- The breaks between batches are 2-3 min (until the full recovery); during this time, the sportsman leaves the simulator bench;
- The test is done for 2 days; in the second day, it starts from the previous day repeat on which the power lowered first time.

With the help of the data, we've build for each subject a force-speed plot. Each plot has peaks which pertain to the tests.

Analyzing the oscillations of these curves, we noticed the following:

After the 2nd test, at the end of the preparing stage for RIC:

- For 4 sportsmen from the experimental group, the curves greatly shifted through low-charge speed 1 and 25 and then closely reach the previous values recorded for the high-charge. For two of them, the forces increased too.
- Two sportsmen from the experimental group show speed much lower than those recorded in stage 1, at low charge, but their speeds increase along with the charge. The force has the same shape as the speed.
- For two of the control group sportsmen, the speeds were almost constant, with a slight increase. The forces lowered especially at high charges.
- The results recorded for one sportsman from the control group show a questionable value for the speed at charge 1, but we can say, looking at the plot shape, that he also manifests slightly increases for the speeds and diminishing of forces.
- Just one sportsman from the control group shows visible lowering both for speed and force, though he can continue the test at greater charges than the initial test.

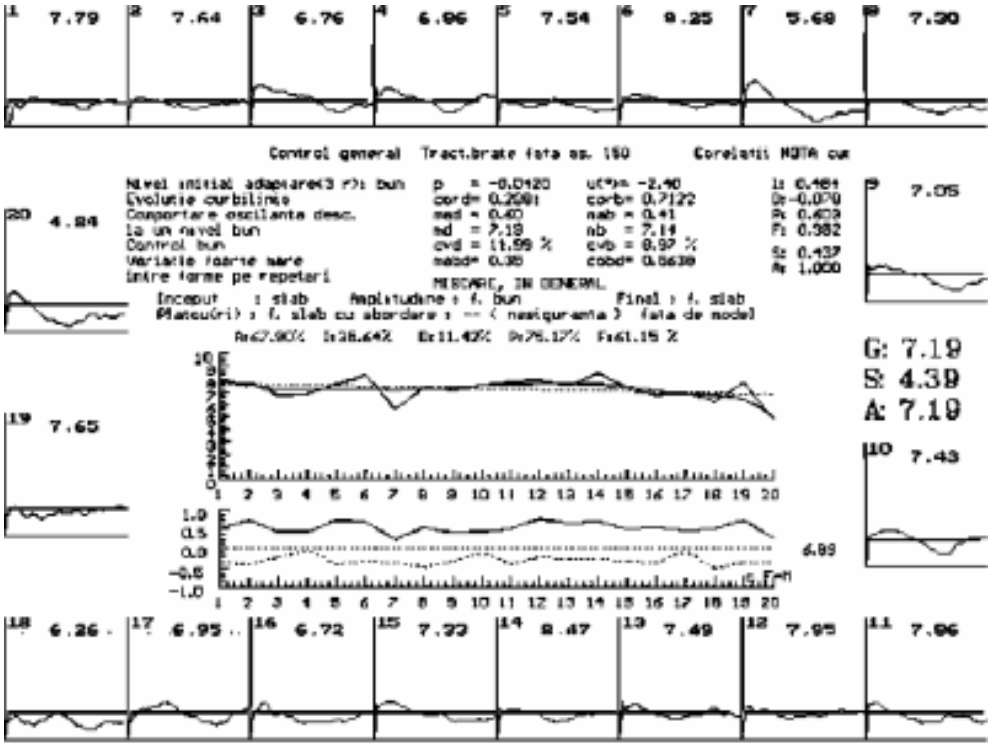

Fig. 1. ***Sample speed test - ERGOSIM***

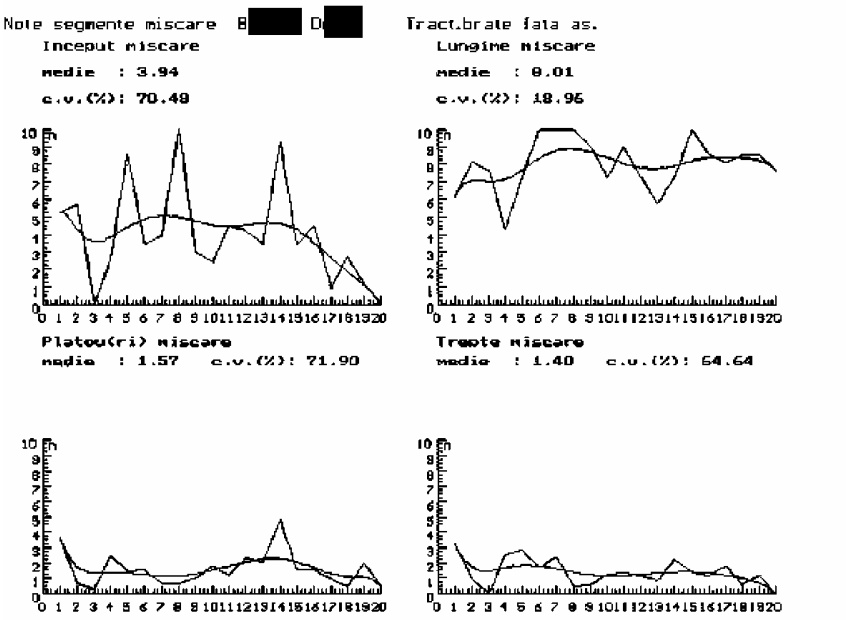

Fig. 2. *Movement segment analysis - ERGOSIM*

On the plots there are recorded the base specialisation for the swimmers too.

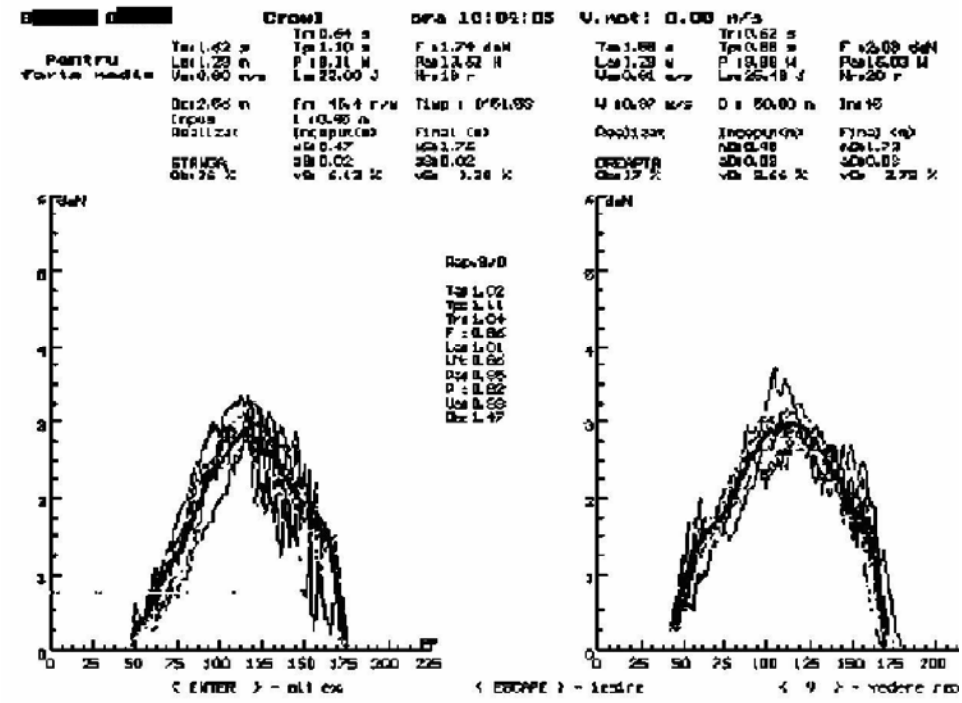

Fig. 3. *Plots after two tests*

It was necessary to extract the technique biases, because the sportsmen, aiming for high speed, are prone to diverting from the right technique (Ignat, C.2005, [8].

From the analysis of video recordings, we acknowledged the following:

- At the beginning of each move, the majority of sportsmen are not able to extend the arms into the water, which leads to the "water splashing" effect [9]. The palm doesn't take from the start, the efficiency of the method decreases (this mistake can be fixed by increasing the force and the mobility)
- On the free and butterfly style, after the arms enter the water, these executes a motion in a shape of "S", out –in –out, but on the simulator the sportsmen didn't execute that motion, but started the "in" movement instead.
- The third error we've identified at the end of the motion, when the sportsmen finished it with the bent elbow; for some this can occur because of the lack of force at the end of the push, for the others the aim for speed increase, by shortening the motion
- All three biases can be fixed by using the force-amplitude plot shown on the simulator's display.

For each subject the analysis of data were made and recommendations were formulated.

5. Conclusions

By analysing the force-speed plots, after the tests done in al three stages, we can draw these conclusions:

There are different behaviours for the swimmers specialised on resistance and those specialised on speed [6], [11].

For the resistance specialisation swimmers (200, 400, 800, 1500m), the evolution in time for the force – speed plot don't differ for engine and engine-free simulator trainings on ERGOSIM.

For the speed specialisation swimmers (50 and 100m), we can see an increase for the force at high speeds when they used the engine-based simulator (twice the movement speed from their personal record).

The specificity of the behaviour can be highlighted in force-speed plots and power-speed plots, which keep the shape, but with slight translations and expansions in the high speed range.

Because the slope for the force-speed and power-speed curves are different for each subject worth an extra attention effort in the methodology plane.

The information facility given by the simulators offers the possibility of approaching an efficient method for the training of resistance of the command and prolonging it during the task.

Despite all methodological drawbacks, it undeniable highlights the role of legs in the energetical metabolism in swimming.

We truly believe we are facing some informations which can become relevant in the selection process for modes and distances.

References

1. Alexe, N.: *Antrenamentul sportiv modern (Modern sports training).* Bucureşti. Editura Editis, 1993.
2. Bompa, T.: *Teoria și metodologia antrenamentului – periodizare (Theory and methodology of training – periodization)*. Bucuresti. Ed. Ex Ponto, CNFPA, 2002.
3. Costill, D.L., Maglischo, E.W., Richardson, A.B.: *La notation*. Paris. Ed. Vigot, 1994.
4. Epuran, M.: *Metodologia cercetării activităţilor corporale (Methodology of Body Activity Research),* Vol I. Bucureşti. IEFS, 1982.
5. Galeru, O.: *Mijloace de evaluare a tehnicii în înotul sportiv (Means of assessing technique in swimming swimming)*. Bacău. Ed. Alma mater, 2014.
6. Hannula, D., Thornton, N.: *The swim coaching bible*. Publishers Inc. Ed. Human Kinetics, 2001.
7. Hillerin, P.: Referat în cadrul programului de doctorat cu titlul: *"Puncte de vedere teoretice şi metodologice privitoare la învăţarea motrică" (Theoretical and methodological views on motor education). Bucureşti.* 1995.
8. Ignat, C.: *Metode tehnice şi aparatura pentru pregătirea de uscat – studiul critic al surselor bibliografice (Technical Methods and Equipment for Dry Preparation - Critical study of bibliographic sources). Referat de doctorat,* Pitești, 2005.
9. Maglischo, W.E.: *Să înotăm mai repede (Let's swim faster)* - Vol. II. Bucureşti. MTS-CCPS, 1992.

10. Manno, R.: *Les bases de l'entrainement sportif*. Paris. Ed. Revue E.P.S, 1992.
11. Șalgău, S., Marinescu, G.: *Adaptarea efortului și programarea la înotători (Adaptation of effort and scheduling to swimmers)*. Iași. Ed. Tehnopress, 2005.
12. Șalgău, S.: *Metodologii în pregătirea înotătorilor de performanță cu ajutorul simulatorului (Methodologies for training swimmers using the simulator)*. Iași. Ed. PIM, 2007.