



REVIEW ARTICLE

Theoretical and Methodical Aspects Regarding the Stroke Strategy in Swimming

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Abstract

Pacing is often neglected in younger swimmers' training sessions. That is why we believe that especially at this level athletes must know and master some important pacing elements that come into play in swimming events. This review aims at approaching the modalities through which the practice of different pacing can ensure swimmers' progress. By selecting a right combination of stroke rate and stroke length, athletes will be able to produce the fastest swimming velocity, according, of course, to their real possibilities.

Keywords: Performance Swimming; Pace Strategy; Stroke Combinations; Effort Distribution

Introduction

We, as coaches, are increasingly interested in the topic related to pacing, race tactics, training evaluation etc. Thus, we constantly try to provide the best solution for our athletes to deal with competitive success. In this paper, we emphasize that the pacing approach in swimming is one of the most pertinent tasks in the athlete's preparation. The optimum combination of swimmer's cycles (arm propulsive movements) and stroke length will lead to the best performance in each particular race distance. Counting the stroke rates and measuring the stroke length are now routinely included in competition reports, but the important point of interest concerns the way in which we can suitably connect them in the training process. Otherwise, if the arm cycles are increased and the covered distance is not, the effect of fatigue on the swimming velocity will be negative. For this reason, we shall try to design in this theoretical and methodological review some pacing plans, which will enable the swimmers to master some combinations of strokes and to improve their ability to maintain an efficient pace in races.

In the specialty literature, we find the assertion that if the swimmers can master a correct stroke strategy, if they can temporally manage their arm movements through a sustained pace, adapted to the swum distance, their results will be improved by up to 0.5 seconds in the 100-m race, for instance [1]. Thus, by extrapolating, we can consider that, on longer distances, the spatial-temporal coordination of specific movements, their synchronization in accordance with the motor task, will determine the performance significant improvement. The pace imposed to the arm movements will influence the athlete's ability to fluently and efficiently develop his motor acts.

Rhythmicization capacity and pacing strategy

Rhythmicization capacity is a complex psychomotor quality, an aptitude to perceive the dynamic characteristics related to the movement changing and restarting in the classical executions. Relying on it, the movement frequency can be modified according to the tactical tasks, without increasing the energy expenditure. Being trainable, the psychomotor quality of imposing a sustained rhythm to movements performed by the body or by its segments contributes to the construction of some proprioceptive reflexes at certain time intervals. It represents the direct knowledge of both the duration of phenomena and the moment changing in the undertaken actions.

The ability to adopt a correct pacing strategy in swimming is related to two elements: perception of temporality and perception of one's own movements.

The *perception of temporality* is achieved not only by the auditory analyzer, but also by the visual and kinesthetic ones. In the psychology works, we find the information that only the very short durations, namely up to two seconds, can be directly perceived. Beyond this limit, only the mental evaluation, mediated by the past experience, occurs. That is why the time estimation is submitted to errors. Usually, the short interval durations are overestimated and the long interval durations are underestimated [2].

The *perception of one's own movements* is a psychic cognitive process differentiated from the kinesthetic-motor sensations. It also includes spatial and temporal elements [3]. The movement characteristics are related to the space particularities (distance, form, direction, amplitude), but also to the time particularities (rhythm, succession, duration, speed). The elementary sensation, namely that of the arm movements, lacks the objective character specific to perception. When our attention is focused on the arm and we don't feel only the impressions of its joints, then we have the perception of the arm in motion and the elementary sensations turn into the movement perception. Thus, the perception of one's own executions becomes concrete [4]. Generally, the muscle message is vague, dull and obscure. That is why if it is defined, differentiated, the movement relation to the space in which it is performed, but particularly to the time dimensions, ensure the elaboration of a refined movement perception, according to which the subject's complex action is integrated.

Pacing Strategy: The stroke strategy choice in any swimming event is one of the most important decisions to be made by the athlete when approaching a race. If in a long-distance event the swimmer changes many times the stroke rate, if the movement schemes are abruptly or discontinuously alternated, he will get tired earlier than desired [5]. For this reason, coaches propose each athlete certain types of race plans. They firstly prepare some competition reports in which they calculate the stroke rate, according to the stroke length and to the swimming velocity. Then, they go back to training and teach their athletes three types of pacing: *even, fast-slow and slow-fast pacing*.

Even pacing requires the swimmer to keep the same pace through the entire race. It is rarely practiced, being rather exhausting because of its monotony; consequently, it is performed by skilled athletes, mostly in the 200-m events. Starting from this idea, we shall approach in our paper the other two tactics. We shall discuss some strategies, some offensive tactics, such as taking the lead, or some defensive schemes, such as racing out slower, which can be used to improve swimmers' pacing in competitions. Our analysis will rely on some plans that, unfortunately, are seldom correctly used in swimmers' preparation, but also on some methodical recommendations for the athletes' pacing education.

Fast-slow Pacing: This strategy is approached by those who feel able to take the race out ahead the competition. They swim faster the early portions of the race, then they keep the pace or slow it down and they sprint at the finish. Taking the lead from the very beginning may occur not only in seniors' long races, but also in children's and juniors' 100-m events. If for the seniors such an approach of the 100-m race is out of discussion, they covering extremely fast the respective distance, the younger competitors have the possibility to alternate or to break the rhythm in this event. Although research has shown that the fast-slow pacing is the least effective of the three methods, it is frequently used in the pacing education [6]. At the same time, we mention that the fast-slow tactics in turbulent swimming pools can be an advantage for the leader/leaders. In these conditions, the others must combat waves by dragging.

In order to correct the race graph approached through the *fast-slow pacing*, we propose the following *training plan* (table 1):

Methods	Events (m)	Methodical indications	Means/number of repetitions	Intensity%	Results
race pacing	100 → 1500	the decreased stroke rate in the second part of the race should be counter-balanced by the execution of some strong and ample arm drags	4 x 4 x 100 m 50 sec. break between repetitions and 2 minutes between series	90-100	simulation of the race conditions and development of the rhythmic sense
classical repetitions	100-500	performance improvement in the initial part of the race will be achieved by reducing a little the stroke rate (1 arm/25 m)	4 x 400 m 55 sec. break between repetitions	90-98	it leads to the optimum combination of the stroke rate and length in short events
ultra-short repetitions	25-50	the correct perception of the arm rhythm is difficult, but it represents the drill key; the estimation of the underwater phase dynamism is required	6 x 8 x 25 m 1 min. break between repetitions and 2 min. between series	98-100	it develops the perception of the maximum acceleration moments while dragging and at the start, as well as the kinesthetic differentiation
double repetitions	400 → 800	the athlete is recommended to speed up on the first two lengths, to slow down the arm rhythm on the next ones and to increase the pace at the finish	3 x 3 x 400 m 30 sec. break between repetitions and 3 min. between series	85-95	it develops the vestibular function through the perception of the acceleration-deceleration moments (either positive or negative ones)
intervals and Fartlek	1500	turns will represent the only accelerated phases across the distances covered at slow pace	2 x 8 x 200 m 30 sec. break between repetitions and 2 min. between series	80-85	algorithms ensure the advanced self-control over one's own technical execution
sensory stimulation	→ 200	- stroke length modification at the sonorous signal; - stroke rate modification at the sonorous signal; - coordination means, with the differentiated application of the water pressure	- 5 x 100 m 20 sec. break - gliding by distributing the force impulses	50-70	accurate identification of the opportunity to initiate or to complete a motor gesture

Negative splitting: *Slow-fast pacing*, also called negative splitting, is the strategy approached by those who want to delay fatigue or acidosis early in the race, by swimming slower and then make up the time by swimming faster at the end. It is mastered by advanced athletes, but the others should also practice and “probate” it in the competition, so that they can judge if it is suitable to them.

In order to correct the race graph approached through the negative splitting, we propose the following training plan (table 2):

Methods	Events (m)	Methodical indications	Means/number of repetitions	Intensity%	Results
race pacing	100 → 1500	the decreased stroke rate in the first part of the race should be sustained by the execution of some strong arm drags	4 x 300 m 50 sec. break between repetitions	90-100	the movement speed decrease guarantees a prompt and technically integrated execution
classical repetitions	100 → 500	performance improvement in the final part of the race will be achieved by increasing the stroke rate and by maintaining the stroke length	4 x 2 x 500 m 50 sec. break between and 2 min. between series	90-98	it ensures the rhythmic development of the performed motor acts
short repetitions	50-100	athletes are required to count their strokes	8 x 75 m 1 min. break between repetitions	98-100	it builds up the sensations of contrast between contraction and relaxation
double repetitions	100 → 400	the imposed rhythm is uniformly accelerated; the breakaway sprint can also be performed	5 x 400 m 30 sec. break between repetitions	85-95	- sedimentation of the <i>perceptive</i> schemes – results of the coordination through permanent temporal transportations [7]; - using a breakaway sprint can demoralize an opponent
intervals and Fartlek	100 → 800	breakaway rhythms are imposed by the coach, but they can also be established by the athlete	2 x 2 x 200 with starts every 4.30 min. and 3 min. break between series	80-90	the perception of temporal landmarks will ensure a more and more pointed decentralization function, as compared to the field effects
sensory stimulation	→ 200	stroke rates should be counted on each covered length (50 or 25 m)	gliding or procedure performed at different paces of the arm and leg movements	50-70	swimming with the relaxation of some muscular groups and the voluntary contraction of others develops the biofeedback; a corresponding distribution of the muscular effort

Discussion

There is a close relationship between pacing and swimming speed. To control the effort distribution, swimmers must analyze their pacing. As most coaches require from their athletes, we also think that the most beneficial way to approach a race is to maintain a longer stroke length later in the competition.

Swimmers tend to choose a combination of stroke rate - stroke length based on their effort feeling (conscious effort) or, even most common, on their intuition. The effect will be positive only when they can demonstrate that they are able to establish a proper relationship between pacing and swimming speed during races. The coach's jobs are to build up some pacing drills and to manipulate a particular and most favorable balance amid the number of arm strokes and the length of each underwater propulsive movement.

Conclusion

In our opinion, the education of the rhythmicization capacity ensures the learning and organization of the muscular interventions in a precise chronological order. It determines the approach of a correct stroke strategy, by gradually consolidating the performance-related sports gestures. The presented drills for improving the relationship between stroke rate, stroke length and swimming speed are based on this psychomotor aptitude. This means should emphasize the race covering in less time, with fewer arm strokes. Within the proposed plans, they can be recommended to all the categories of swimmers.

The methods enabling us to know the optimum pace or, in specialized terms, the “stroke rate”, are numerous. But we think that those presented by us in this paper are among the simplest and the most efficient tactics that can be used in competition, in order to achieve a correct competition graph. Thus, the very good intermediate times, with a slightly reduced arm frequency (1-2 arms) on each length, will prove a preparation directed to the mastering of a valuable competition pace. In this case, the athletes won't focus any more on the way in which they must distribute their effort, but they will learn to swim at the correct velocity, in the most economical manner.

Anyhow, athletes must practice at different stroke rates and stroke lengths, in order to experience the less exerting combination. They must “feel” the acceleration/deceleration moments that will be then superposed to some correct and ample strokes. We should influence their stroke rate and length at the desired velocity.

Swimmers will become able to take the lead, to break the rhythm in a spectacular and demoralizing way for the opponents or to preserve their energy for the final sprint. They can practice their own combinations of stroke rate and length, but they must be prepared to choose, in conditions of adversity, the most valuable stroke strategy, optimally adapted to the race distance and to their real capabilities.

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