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The influence of chosen factors on athletes' competition results in different stages of training – exemplified by fencing / Wpływ wybranych czynników na wyniki w zawodach w różnych etapach treningu – na przykładzie szermierki

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Once a fencer has learned the mechanism of basic movements, the activity loses its primary, total physical requirements and becomes more of a mental exercise. Concentration, self-control and a quick decision command muscles and reflexes for successful scoring.

Michel Alaux

Key words: stages of training, change of tasks and ways of conducting exercises in various stages of training, application of technique, tactics and psycho-motor abilities in various stages of training

The author discusses the influence of all-round, semi-specific and specific fitness, elementary technique and psycho-motor abilities (psychological processes connected with motor performance) on fencers' competition results in various stages of training. Then he describes fencers' learning, perfecting and applying technical and tactical skills in three phases. His conclusions are based on a set of specially chosen tests, observations and analysis of competitions.

Introduction

The fatigue encountered in swimming and running is mainly in the effector mechanism so that hard physical training can make a great difference to performance in the longer events. In fencing and the racket games on the other hand the receptor and translation mechanisms are as important as the effector.

Barbara Knapp

Some sport scientists and some coaches in many branches of sport divide the many years lasting long process of training into following stages:
- All-round fitness (general, basic fitness),
- Semi-specific fitness,
- Specific fitness,
- Technique and tactics.

I consider this classification to be very one-sided and primitive. I prefer the classification of training stages which takes into consideration many aspects and component parts of training process. Much more logical and versatile classification is dividing the entire process of training into following stages:
- Introductory stage,
- Basic stage,
- Competition stage,
- Champion stage.

Practically all components of training, aims and tasks, methods and forms etc., change considerably in consecutive stages of training (for example the value, importance and influencing the results in competitions of all-round fitness is valid and well marked only in the first, introductory stage of training. In other stages of training its influence on competition results markedly diminishes, it is only good as an active rest, psychological relaxation, prevention of traumas and it speeds up the process of recovery after heavy effort).

In the article I describe and discuss how teaching, learning and applying the technique, tactics and psychomotor abilities (the executive psychological processes connected strongly with motor activities – perception on conceptual-motor level, speed and accuracy of motor responses, sense of timing, fast decision making etc.) undergo considerable changes and influence competition results differently in various stages of training.

This article is based mostly on my personal experience in fencing (70 years of fencing activities – competitor, coach, judge. researcher, author) careful observation of exercises and competitions and various tests conducted in the Fencing Department, Academy of Physical Education, Katowice, Poland. Although my conclusions, advice, views are strongly connected with fencing one may assume that they will be of value and importance in other branches of sports, especially in sports with many open (extrinsic) sensory motor skills, of cognitive-motor variety (combat sports, sport games etc.) [Czajkowski 1991, 1995, 2004, 2005 a, b].

Energy abilities, coordination, psycho-motor processes in different stages of training and their influence on competition results

Running round the pitch does not improve
the efficiency of soccer player,
just the same as walking round the table
does not improve the billiard player's skills.

Zbigniew Czajkowski

Before we tackle the main theme of this part of the article, the principle of specificity of training ought to be stressed. The coach must remember a very simple rule: what is good for one branch of sport may not be so good for another. As happens very often, the obvious things are not easily noticed, and the obvious conclusions are not put into practice.

Concerning transfer of skill, we may differentiate positive transfer (the exercises develop the right physical abilities, co-ordination skills for a given branch of sport, and are applied in competition), neutral transfer (the exercises do not influence athletes' skilfulness or results in competition, neither positively nor negatively), negative transfer (the exercises have a negative influence on performance in a given branch of sport).

Many coaches overestimate the value of energy (physical) fitness in fencing, especially all-round, general fitness, and apply, for example, long-distance running, which produces a long-distance runner's endurance and is rather useless in fencing; or they apply a lot of weight-lifting exercises, developing the size, strength, and power of muscles, but spoiling the subtle and accurate yielding of a weapon. As Albert Einstein wittily and cleverly remarked, "After working with a pick-axe, one does not play violin".

Many coaches, not only overestimate the value of basic fitness in a fencer's training, but also disregard the fundamental necessity of changing the structure of training and the choice of exercises in different training stages: taking into account an athlete's age, experience, technical skills, etc.

Different kinds of energy fitness (all-round, semi-specific, and specific fitness), like other component parts of the training process, change markedly in their significance, and influence on competition results, in different stages of training.

This ought to be obvious when one considers elementary knowledge of physiology, psychology, sport science, the effects of different exercises on the human organism, etc.; and it is confirmed by empirical evidence and by research and various tests. As the head of the Fencing Department at the Academy of Physical Education in Katowice, I have conducted numerous tests to find out the most important factors in training, in different stages of a fencer's career [Czajkowski 1991, 1995, 2005].

Before I describe, in short, one typical set of tests showing the changing importance of various kinds of energy (physical) fitness, and other factors, on a fencer's results in different stages of training, I am going to remind, in a very short, concise and simplified manner, the meaning of the words: all-round, semi-specific, and specific fitness: 1) all-round (general, basic) fitness, state of muscles and other organs, motor performance, specific movements, and physiological processes, not connected with, nor resembling, a given branch of sport (e.g., for a fencer: running, jumping, swimming, cycling, certain gymnastic exercises, etc.); 2) semi-specific fitness, motor performan-

ce, forms of movements, and physiological processes, not exactly the same as in a chosen branch of sport, but similar and helpful for the development of specific fitness, positive transfer of skills (e.g., for a fencer: lunge or fleche from a squat-down position; catching a tennis ball or bean bag with a lunge or fleche; summersault then fleche; sitting crossed-legged, then jumping to on-guard position as fast as possible on a given signal; etc.); 3) specific fitness, movement and physiological processes, used exactly as in a chosen branch of sport (e.g., for a fencer: movement and physiological effort used in proper fencing exercises and bouting).

Now, I will describe one set of tests which I conducted a few years ago with sixty leading sabreurs of the Silesian Voivodship. These tests gave a mass of information and led to many conclusions. I shall discuss only a few of the most important and valid ones. I will depict the tests in a very short manner, without giving hundreds of figures, detailed statistical analyses, etc.

Sixty fencers were divided into four groups, according to their age (and, of course, length of training): 1) 13 years old and younger (introductory stage of training); 2) between 14 and 17 years old (basic stage of training, beginning of competitive stage); 3) 18 to 20 years old (competitive stage); 4) older than 20 (competitive and champion stages).

The numerous and various tests included assessment of:

- All-round (basic, general) fitness.
- Semi-specific and specific energy fitness, and the most elementary technical skills.
- Chosen psychomotor abilities (speed and accuracy of sensory-motor responses, visual-motor co-ordination, concentration of attention, etc.).

In each age group (stage of training), I prepared a ranking list based on competition results for one year.

All-round energy fitness was assessed by a set of tests containing: a 30m run, starting from a standing position; running 4m, ten times (back and forth); an "envelope" run; bending over (flexibility); sit-ups; long-jumps (without running); push-ups with hand-clapping; throwing a 3kg medicine ball.

The test of semi-specific and specific physical fitness, plus basic technical capabilities, contained: catching a tennis ball with fleche twenty times; speed of fencing steps – advances and retreats, 4m, five times, as fast as possible; specific speed: execution, five times, of cut to head with fleche; speed and accuracy of fencing actions: execution, five times, of a compound action – four-beat and cut to head with lunge, return to on-guard position, and attack with feint to head, cut to flank with fleche; speed of reaction and movement: fifteen times, attempt to hit a falling glove with a thrust with lunge; psychomotor abilities: speed of various types of reaction and various aspects of space-time orientation measured on a special apparatus.

Special ranking lists for each age group were made. Analysing the ranking lists of various tests, and the ranking lists of results in competitions, using various statistical methods, we drew many interesting conclusions (see Fig. 1 and Table 2).

The most important results of these tests indicate that:

The correlation coefficient between all-round energy fitness and a fencer's results in competitions diminishes markedly with the age and training experience of the fencer, from 0.81 (in the youngest group) through 0.68 and 0.39, to 0.29 (in the senior group). It shows that all-round fitness is important, really, only at a very young age, in the first stage of training. Later on, its significance diminishes. Among senior fencers, on competitive and champion stages, all-round fitness does not improve competition results; it only provides active rest, psychological relaxation, prevention of traumas, and facilitation of after-effort recovery.

Very young fencers, in competition, have to rely mostly on all-round, basic energy fitness (strength, endurance, speed, power, mobility) because their technique and tactics, fencing experience, perception, and speed and accuracy of reaction are still rather poor.

The correlation between all-round (physical) fitness, on one side, and semi-specific and specific fitness, and basic technical skills, on the other side, gradually diminishes: 0.87, 0.79, 0.66, 0.30. It again shows that the value and significance of all-round fitness in the later stages of training is greatly overrated.

The correlation between semi-specific and specific fitness, and basic motor skills, on one side, and the results of competition, on the other, diminishes very little over time and is always, in all stages of fencing, and all ages of fencers, very important: 0.95, 0.84, 0.80, 0.75.

The coefficient of correlation of psychomotor abilities and results in competition, constantly increases: 0.62, 0.63, 0.51, 0.75. It means that on all stages of training, and with fencers of different ages, one should pay a lot of attention to the development of specific psychomotor abilities strictly connected with a fencer's motor activity: speed and accuracy of perception, speed and accuracy of reaction, visual-motor co-ordination, etc. (The coefficient of correlation, 0.51, in the 18–20 age group, is due to a well-trained and talented fencer who showed excellent results on reaction meters, and in other psychological tests, but whose too-high level of motivation and arousal considerably lowered his results in competition–he was ranked number 15 in his group.) [Czajkowski 1991, 1994, 2004, 2005 a, b].

Then the final and obvious conclusion may be summarized as follows. In a fencer's training, one should take into account the principle of specificity (and individualization, of course) to ensure successive transfers of skill from exercises to training bouts`, and from training bouts to competitions. In choosing exercises and the methods of conducting them we should pay attention, above all, to those factors which markedly influence the level of performance, efficacy of actions, and results in competitions, taking into consideration various tasks of different training stages.

The phases of learning perfecting and applying technique and tactics in different stages of training

The development of technique requires regular practice attention and concentration, and constant correction. a fencer is like an opera singer who needs lessons on a regular basis to improve or maintain his or her high standard of performance. Lessons have different purpose aiming at a different aspects of the development of technique and tactics.

Michelle Alaux

Teaching, perfecting and applying technique and tactics may be divided into three phases:

1. In the first, introductory stage of training: first cognitive phase of learning technique and tactics,
2. In the second, basic stage of training: the second, intermediate, associative phase of learning technique and tactics,
3. In the third, competition, and fourth, champion stage of training: the third autonomous, advanced stage of learning technique and tactics [Bradford 2004; Czajkowski 2004, 2005; Fitts 1964; Schmidt 1998].

Ad 1. In the early, cognitive, phase of learning technique and tactics (first, introductory phase of training) the young pupils try to understand the sensory motor skills and learn the ways of executing them, at the beginning – in rather easy – and even artificial conditions: no speed, no reaction, coach's help. Later on the young fencer tries to execute various fencing actions (sensory-motor skills) in more realistic conditions, with constantly changing situations and with an opponent. His attention, however, is much more concentrated on how to execute a chosen action than on when and which action to choose. The beginner does not notice his errors and mistakes (errors of perception, errors of decision making, errors of execution). Here again fencing master's help is very necessary. For a long period of time beginner's vision and other receptors are concentrated on how to execute a given action and not so much on what and when to apply. The improvement of speed (executing of gradually faster movements) takes some time and at the beginning it is due to faster execution of an action (the final, executory period of motor response); the reaction time of the latent period of motor response – is still rather long – slow reaction. The young fencer slowly, gradually eliminates the unnecessary movements: undue contraction of muscles, too wide movements, bad rhythm, false co-ordination of component parts of an action etc. In training bouts and early competitions the beginner does not take advantage of preparatory actions (reconnoitering, concealing one's own intention, misleading the opponent etc.). In real action he uses mostly foreseen, first intention attacks, has difficulties in recognizing opponent's intentions, his choice of action is often wrong and so are ways of execution of a chosen action. The competition results on this stage of learning are very unstable.

Ad 2. **In the second intermediate, associative phase of learning and applying technique and tactics** (second – basic – stage of training process) the fencer gradually pays more attention to what to do, which action to choose in a given tactical situation than how to perform the chosen stroke. His technique becomes gradually more fixed, more automated. His vision gradually shifts from controlling the execution of action towards assessing the tactical situation, opponent's movements and choice of action. His sensory-motor responses become faster and more accurate. He commits fewer errors (especially errors of execution) and slowly begins to notice the mistakes himself. The errors – when they occur – are not so big and significant. The increase of speed in this phase is due rather to faster and more ably execution of movement (final, executory period of motor response) than due to faster reaction (latent period of motor response). Gradually the repertoire of applied fencing actions – both preparatory and real ones – increases. He improves his tactics by introducing second intention actions. One can notice a certain improvement of speed and accuracy of perception, sense of timing, level and quality of attention and motor adaptability.

Ad 3. In third – autonomous advanced phase of learning and applying technique and tactics (the third – competition and fourth champion stage of training process) the fencers – especially in the champion stage of training, perform with more confidence, more efficiently, with fast and accurate reactions, high speed of movements and much more variety of fencing actions. They gradually begin to use and then apply them aptly and with success: foreseen and unforeseen actions, first intention and second intention actions, then apply action with unknown final and actions with change of intention („open eyes" actions). The speed of their movements is mainly due to better speed of reaction: shorter latent period of motor response (from appearance of a stimulus to beginning of action). Top, experienced fencer reacts often to a pre-signal of a real action. In this phase the motor reaction becomes much faster and accurate. Much less errors are committed. The errors or mistakes, when they occur, are not so obvious and important. The competitors notice errors themselves and try to eradicate them. The various qualities of attention are markedly improved: level of concentration, range of attention, divisibility of attention, shifting of attention (from extrinsic to intrinsic and vice versa; from wide to narrow and vice versa). Experienced fencer's vision and attention are entirely focused on fast assessment of tactical situation and opponent's actions and not on how to execute a chosen fencing stroke. The sensory-motor skills – fencing actions – are fully automated and control of their execution is on the subconscious level (fourth stage of motor skill – motor habit pattern – acquisition + high level of motor adaptability with lightning speed improvisation. This means that an experienced fencer can execute a movement or string of movements which he never practiced before in exactly the same form. In this phase the individual style of fencing – taking advantage of one's own profile of personality, traits of temperament, level of arousal, motif of success etc. – becomes prominent. The experienced, well trained fencer uses in competition bouts all varieties of motor responses : simple reaction, choice reaction, differential reaction; reaction to a moving object, reaction to pre-signal, switch-over reaction (change of intention during execution of a foreseen action), reaction based on „statistical intuition". The individual style of fencing becomes more and more prominent and efficacious – a fencer tries to take advantage of his strong points (Table 2).

REFERENCES

1. Bradford V. (2004), *Motor learning principles and the application in teaching and coaching fencing*, "The Swordmaster", Summer-Winter.
2. Czajkowski Z. (1991), *Z badań nad czynnikami wpływającymi na wynik sportowy w szermierce* [w:] *Podstawowe problemy badawcze w naukach kultury fizycznej*, AWF, Katowice, s. 147–156.
3. Czajkowski Z. (1994), *Zdolności sprawnościowe a nawyki ruchowe*, „Sport Wyczynowy", nr 5–6.
4. Czajkowski Z. (1994, 1995), *Nowe spojrzenie na etapy szkolenia*, „Sport Wyczynowy", nr 11–12 i 1–2.
5. Czajkowski Z. (2004), *Nauczanie techniki sportowej*, wyd II, Resortowe Centrum Metodyczno-Szkoleniowe Kultury Fizycznej i Sportu, Warszawa.

6. Czajkowski Z. (2005 a), *Teaching, learning perfecting and applying fencer's technique and tactics in different stages of training*, "The Swordmaster", Winter-Spring.
7. Czajkowski Z. (2005 b), *Understanding fencing – unity of theory and practice*, SKA Swordplay Books, Staten Island, New York.
8. Fitts P.M. (1964), *Perceptual-motor skills learning* [in:] A.W. Melton [ed.], *Categories of human learning*.
9. Schmidt R.A. (1998), *Motor Control and Learning*, Second Edition, Champaign.

Słowa kluczowe: etapy treningu, zmiana zadań i sposobów prowadzenia ćwiczeń w różnych etapach treningu, zastosowanie techniki, taktyki i zdolności

STRESZCZENIE

Autor omawia wpływ ogólnych, ukierunkowanych i swoistych zdolności wysiłkowych, podstaw techniki i procesów wykonawczych (procesy psychiczne ściśle związane z działalnością ruchową) na wyniki szermierzy w zawodach w kolejnych etapach szkolenia. Następnie opisuje uczenie się, doskonalenie i stosowanie techniki i taktyki w trzech fazach. Jego wywody oparte są na zestawie odpowiednio dobranych sprawdzianów oraz na obserwacji i analizie zawodów.

ANEKS / APPENDIX

Table 1. The correlation between various kinds of energy fitness, psychomotor abilities, and results in competition, depending on age and training stage. / Tabela 1. Współzależność (korelacja) różnych rodzajów sprawności fizycznej, zdolności psychoruchowych i wyników w zawodach w zależności od wieku i etapu treningu (Z. Czajkowski)

	Coefficient of Correlation / Współczynnik korelacji			
Age Group Grupa wiekowa	yz	yx	xz	Az
13 and under 13 i poniżej	0.81	0.87	0.95	0.62
14–17	0.68	0.79	0.84	0.63
18–20	0.39	0.66	0.80	0.51
Over 20 ponad 20	0.29	0.30	0.75	0.75

yz – coefficient of correlation between all-round fitness and competition result / współczynnik korelacji sprawności ogólnej i wyników w zawodach,

yx – coefficient of correlation between general and specific fitness / współczynnik korelacji sprawności ogólnej i swoistej,

xz – coefficient of correlation between specific fitness and results in competition / współczynnik korelacji sprawności swoistej i wyników w zawodach,

Az – coefficient of correlation between psychomotor abilities and results in competition / współczynnik korelacji zdolności psychoruchowych i wyników w zawodach.

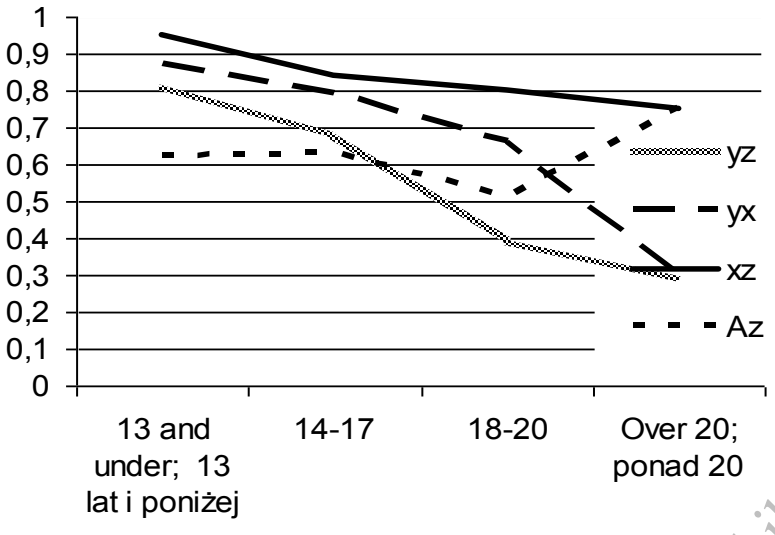

Fig. 1. The interrelationship between various kinds of physical fitness, psychomotor abilities, basic technical capabilities, and competition results of fencers of different ages / Ryc. 1. Współzależności między różnymi rodzajami sprawności fizycznej, podstawowymi umiejętnościami technicznymi i wynikami w zawodach szermierzy w różnym wieku

Table 2. Phases of teaching, coaching and applying technique and tactics on different stages of training (Z. Czajkowski)

Phases of mastering and applying of technique and tactics	**Characteristic properties of applying fencing actions in competition**
Introductory (cognitive) stage of technique (first phase of training)	• numerous errors, • errors of perception, choice of action and execution, • very changeable, not stable results, • a competitor does not notice and does not evaluate his errors and mistakes, • advice and assistance of a coach in spotting and eliminating errors is necessary, • a competitor focuses his attention on how to execute an action (conscious visual control), and not – or to much less extent – on evaluation of fighting situation and choice of proper action, • the improvement of speed occurs gradually as a result of elimination of by-movements and unnecessary muscle contractions, • small range and low level of preparatory actions, • offensive actions mainly foreseen, executed as a first intention action, • low level and poor applying of psychomotor capabilities (perception, different traits of attention, reactions etc.)
Intermediate (associative) technique and tactics phase (at second, basic training stage)	• basic actions better mastered, better execution of selected actions, • errors less numerous, better – faster and more appropriate perception, greater and more changeable scope of attention, better choice of action, better quality of actions execution, • errors less serious, • stress to more an more efficient and faster execution of actions, • a competitor begins to notice some of his errors, • a competitor attempts to eliminate noticed errors, • results more stable, • gradually more and more attention pays to what to do, and not how the chosen action has to be performed (visual control of performance gradually diminishes while evaluation of tactical situation becomes more important; execution more and more relies upon proprioceptive senses), • the improvement of speed results mainly from acceleration of movement execution (fencing actions), i.e. shortening of executory (final) stage of a sensory-motor response, greater variety and higher level of preparatory actions, • enriching the tactics by applying foreseen second intention actions, • gradual increase of importance and application of psychomotor abilities (more accurate and fast perception, sense of surprise, different versions of sensory-motor responses, different ways of choosing an action).

Phases of mastering and applying of technique and tactics	Characteristic properties of applying fencing actions in competition
Third technique phase, or many-sided and purposeful actions (occurs in third, competitor, and fourth, champion stage of training)	• sensory-motor skills and technical-tactical capabilities, based on sensory-motor responses, as well as tactical capabilities basing on observation, perception and thinking more and more mastered, • a competitor focuses his attention on proper and fast perception of fighting situation, selection of a proper action, on how to fake the rival, and not on how to execute a chosen action, more rich and variable range of applied actions, • various methods of choosing and applying of actions; actions foreseen as a first intention and second intention ones, actions not foreseen, actions with not known result, actions with change during its course, • better quality, precision and speed of execution of chosen action, • much less errors of perception, selection and execution, • a competitor employs many different actions according to situation, • a competitor discovers his errors and tries to eliminate them, • results more and more stable, • improvement of speed of action results mainly of shortening the latent period of a motor response (from appearing the essential stimulus to beginning of the movement), and – gradually more and more often – as a result of reaction to pre-signal of a proper movement,bigger range and variety of preparatory actions and their increased efficacy (identifying the movements unveiling the intentions of a rival, hiding own intentions, faking the rival, drawing from the opponent actions in order to score a hit, timing, fast situation evaluation etc.) employing various versions of action choices, i.e. actions foreseen (as first and second intention ones), action with unknown ending ("open eyes"), actions with change during their execution, • very high (especially in the fourth phase) level of psychomotor abilities and their skillful employing.

Tabela 2. Stadia opanowywania i stosowania techniki oraz umiejętności techniczno-taktycznych i taktycznych (Z. Czajkowski)

Stadia opanowania i stosowania techniki	Znamienne właściwości działania
stadium techniki wstępne, czyli poznawcze (występuje w pierwszym – wstępnym etapie szkolenia)	• duża liczba błędów, • powszechne błędy postrzegania, wyboru działania i wykonania, • wyniki osiągane w zawodach bardzo zmienne, niestałe, • zawodnik nie dostrzega ani nie ocenia swoich błędów i pomyłek, • w dostrzeżeniu i usuwaniu błędów potrzebne uwagi i pomoc trenera, • zawodnik skupia się na sposobie wykonania działania (świadoma kontrola wzrokowa), a nie – lub w znacznie mniejszym stopniu – na ocenie sytuacji walki i wyborze odpowiedniego działania, • poprawa szybkości następuje stopniowo w wyniku usuwania przyruchów i zbędnych napięć mięśniowych, • mały zakres i niski poziom działań przygotowawczych, • działania zaczepne przeważnie przewidziane, wykonane w pierwszym zamiarze, • niski poziom i nikłe stosowanie umiejętności psychoruchowych (postrzeganie, różne właściwości uwagi, reakcje etc.)
stadium techniki pośrednie, czyli skojarzeniowe (występuje w drugim – podstawowym etapie szkolenia)	• podstawowe działania już lepiej opanowane, lepsze wykonanie wybranych działań, • błędy mniej liczne, lepsze – szybsze i bardziej trafne postrzeganie, większy i zmienny zakres uwagi, bardziej trafny wybór działania, lepsza jakość wykonania działań, • błędy mniej „poważne", nacisk na coraz sprawniejsze i szybsze wykonanie ruchu, • zawodnik zaczyna sam dostrzegać niektóre błędy, • próby poprawienia zauważonych błędów, wyniki bardziej stałe, • stopniowo coraz więcej uwagi poświęca na to, co ma wykonać, a nie jak wykonać wybrane działanie (kontrola wzrokowa stopniowo przechodzi na ocenę sytuacji taktycznej, a wykonanie coraz bardziej oparte na czuciu głębokim, mięśniowo-ruchowym), • poprawa szybkości następuje głównie w wyniku przyspieszenia wykonania ruchu (działania szermierczego), a więc na skutek skrócenia okresu wykonawczego (końcowego) odpowiedzi czuciowo-ruchowej, • nieco większy zakres i wyższy poziom działań przygotowawczych, • wzbogacenie taktyki poprzez stosowanie działań przewidzianych w drugim zamiarze, • stopniowy wzrost znaczenia i wykorzystywania zdolności psychoruchowych