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IMPROVING ATTENTIONAL PROCESSES IN SPORT: CLASSIFICATIONS OF EXERCISES AND PRINCIPLES OF DEVELOPMENT OF ATTENTIONAL SKILLS

Key words: attentional skills development, principles and exercises.

ABSTRACT

In our search for hints and ideas on improving attentional processes in sport, we analyzed in previous articles the concept of attention and differentiated between various types of attention and attentional skills [13]. We also tried to identify sport specific issues of attention, using a comparative case study of tennis [14]. In this paper we want to suggest another possible attitude, i.e. studying various exercises and ideas used to or recommended to improve attention in sports. This approach, which appraises the art of attention improvement, combined with the theoretical analysis conducted in previous articles, has enabled us to develop several classifications of attentional exercises, identify environmental factors stimulating and challenging attention and finally define principles of development of attentional skills.

Let us start with the analysis of exercises suggested by different authors for developing attentional skills in sports. Please note that in Tables 1-5, 7-11 below the left column always contains brief descriptions of exercises, usually shorter than the original versions found in literature. The right column includes analysis aimed to define attentional challenges of the given exercise or the underlying concept, idea or mechanism of attentional skills improvement. Tables 6, 12 and 13 include exercises that we use in our daily coaching practice and an analysis of their value and potential for developing attentional processes in sport. All exercises discussed were divided into general exercises and sport specific exercises.

ANALYSIS OF GENERAL ATTENTION- -IMPROVING EXERCISES

The first group of attentional exercises that we analyzed is rather small and was originally developed for fencing training by Czajkowski [5]. Nevertheless, they served the author as examples and should be perceived as such because they do possess a more universal character and can be easily modified for different sports and purposes (Tab. 1).

Our analysis shows that these exercises are characterized by extraordinary demands of quick reactions and correct decision making. We agree with the author that these requirements have

enormous potential to stimulate and challenge athletes' attentional processes.

Probably one of the most comprehensive sets of attentional exercises was presented by Morris & Summers [10]. Because of the great number of suggested items we divided them into tasks requiring more internal focus and those emphasizing external or mixed focus. The first

group of exercises directs the athletes' attentional focus to the internal stimuli such as the physiological processes of the body (breathing, brainwaves, heart rate), kinesthetic sensations, thoughts and internal images, even if the trainees are sometimes asked to monitor them with the help of electronic devices (Tab. 2).

Table 1. Analysis of attentional exercises used in fencing training

EXERCISE DESCRIPTION	ANALYSIS
1. "Fast reaction" – on seeing the coach step forward (A) the learner should respond by making a simple attack with a lunge (B).	Fast reaction (and anticipation) required. Simple reaction to a set stimulus (A) with a set response (B).
2. "Find the right reaction 1" – on seeing the coach approach (A), the learner responds with an attack (B), on seeing the coach attack (C), the learner responds with a block (D) or a counterattack (E).	Fast choice reaction (and anticipation) required – the performer should make one of three choices (B, D or E), when confronted with two different stimuli (A or C), visual attention, switching attention.
3. "Find the right reaction 2" – the coach makes a series of attacks (A), which the learner should block (B), from time to time the coach moves forward with a bent arm (C), which should make the learner respond with a counterattack (D).	Fast choice reaction (and anticipation) required – the performer should make one of two choices (A or D), when confronted with two different stimuli (B or C), visual attention, switching attention.
4. "Find the right reaction 3" – the learner makes a series of attacks (A), and the coach allows the learner to hit him (B), but from time to time he parries the attack and gives a riposte (C) – then the learner should respond with a counter-riposte (D).	As above.

Table 2. Analysis of general attentional exercises requiring internal focus

EXERCISE DESCRIPTION	ANALYSIS
1. "Monitoring one's own thoughts" – the player is trying to observe his own thoughts without interrupting them.	Focusing attention on one's own current thoughts also means focusing on the present events.
2. "One thought only" – the player is trying to focus on a single thought or idea for as long as possible.	Long attention span required.
3. "Centering" – the player is supposed to observe his breathing, especially the process of lifting and lowering of the stomach area (his "body center").	Focus on the present events required – monitoring the process of breathing.
4. "Closed eyes" – the player closes his eyes and is either balancing on one leg, on a boat or moving around guided by an assistant.	Kinesthetic attention (equilibrium) – turning to one of the senses (here: the sight) sharpens the remaining senses.
5. "Disturbed visualization" – one player is visualizing, another one is trying to disturb him.	Focusing attention on internal images. Learning to ignore external disturbing stimuli.
6. "Biofeedback" – monitoring brainwaves, skin electrical resistance, heart rate, muscle tension or body temperature with the use of measuring devices.	Increasing the awareness of physiological processes as well as the influence of thoughts on physiological reactions.
7. "Anchoring" – neutralizing negative, disturbing thoughts, by writing them on pieces of paper to refer to later on.	A technique also known as "parking thoughts" that can be useful for coping with insistent, disruptive thoughts.

After a thorough analysis we can state that the second group of exercises suggested by Morris & Summers [10] involves first of all tasks requiring more external focus such as watching the second-hand of a clock, observing one's own thumb or the surroundings, following different actions on a computer screen, examining details of a sport specific object, searching for specific numbers on a sheet of paper, etc. (Tab. 3).

One should also emphasize the idea of setting measurable precision tasks, for example, basket throws with an additional attentional

challenge of having to execute them repeatedly at the end of a training session when athletes are already tired (Exercise 7, Tab. 3).

Apart from Morris & Summers (Exercise 8, Tab. 3) several other authors stressed the necessity of creating a training atmosphere that most closely resembles competition, including all possible distracters, such as opponents cursing the player out loud, cheating, angering and upsetting him, noisy and hostile audience, bad line calls, windy conditions, very high or very low temperature, tiredness and so on [6, 8, 11, 12, 15].

Table 3. General attentional exercises requiring external and mixed focus

EXERCISE DESCRIPTION	ANALYSIS
1. "Watch the second-hand of a clock" and bat an eyelid (or tap with a ball pen) in a set time interval, e.g. every 5 sec. or alternately every 5 and 10 sec.	Need for correct timing of a specific simple movement with changes in positioning of the second-hand of a clock.
2. "Computer and video games" that give instant feedback on performance.	Following fast moving objects on the screen and quickly assessing the changing situation coupled with executing simple actions (striking the keyboard), etc.
3. "Grid exercise" – searching and marking numbers in a set sequence (from 00 to 99) that are displayed randomly on a table.	Need for quick assessment of the situation in searching for adjoining numbers.
4. "Watch the thumb or the environment" : switching between looking at one's own thumb and the surrounding environment.	Narrowing and broadening the scope of attention, switching attention.
5. "Examining an object" – the player should carefully examine the smallest details of a sport specific object (e.g. a ball or a racket) and then switch his attention to the surrounding environment.	Narrowing and broadening the scope of attention, switching attention.
6. "Hard or soft look" – narrowing and broadening the scope of attention with the help of contracting or relaxing the eye muscles (respectively).	Managing the scope of attention and switching attention.
7. "Measurable tasks" – e.g. perform 85% successful basket throws during a training session or make 20 consecutive throws at the end of a training session.	Measurable goals requiring precision and many successful repetitions, with tiredness (at the end of a training session) being an extra challenge.
8. "Competition atmosphere" – proper outfit, pre-competition ritual, warm-up, referees, audience, weather conditions, opponents (game style), order of play, bad officiating, fans' shouts and remarks.	Getting used to certain stimuli, which otherwise (when new, untypical or exceptional) could unnecessarily attract athletes' attention.
9. "Find the cause" – the player is supposed to find a reasonable cause of his (her) mistake.	Focusing attention on constructive, task-related thoughts – problem solving.
10. "Keywords" – e.g. "relax", "enter the tunnel", "keep in touch", "find rhythm".	Focusing attention on task-related aspects of performance expressed by the relevant words.
11. "What, if ...?" – discussion with players, working on strategies to cope with different situations.	The player and the coach try to work out in advance specific reactions (behaviors) for all competition situations they can possibly think of.
12. "What is controllable?" – the coach and the player try to identify factors that are under the player's control.	Directing the player's attention on factors that are task-relevant and under his direct control.
13. "Affirmations, quotations, goals" – written on posters, pieces of paper, etc.	Directing athlete's "everyday" attention on inspiring, motivating, energizing and increasing confidence ideas.

Morris & Summers also developed four different techniques for helping athletes focus on task relevant aspects of performance, beginning with the idea of seeking a reasonable cause after making a mistake, using task relevant key words, preparing in advance and then implementing the so-called coping strategies for special match situations and, last but not least, differentiating between factors that are under direct control of the player, i.e. those the athlete has little control over or are

completely out of his control (Exercises 9-12, Tab. 3).

An interesting idea for occupying an athlete's mind in everyday life with inspiring, motivating, energizing or confidence increasing thoughts consists in writing such statements on pieces of paper or posters and distributing them in strategic places, e.g. on a mobile phone or computer screen, desk, wall or door in the athlete's room, racket bag, sport bag, etc. [10, 11].

Table 4. Analysis of general attentional exercises as suggested by Weinberg & Gould

EXERCISE DESCRIPTION	ANALYSIS
1. “Employ nonjudgmental thinking” – athletes are asked to see their performance as it is (e.g. are the shots slow or fast, high or low, long or short, etc.) without adding judgments, i.e. without categorizing it as good or bad.	Preventing the athletes from unconstructive generalizations, leading to disruptive feelings such as anger, frustration or discouragement.
2. “Eye control” – athletes are asked to make sure that their eyes do not wander to irrelevant cues and keep them on the floor, on the strings of a racket, on the equipment, on a spot on the wall, on the ball.	Preventing the eyes from seeing distractions such as motions in the crowd, antics by opponents, signals that officials are giving, outbursts from coaches, behavior of teammates, etc.
3. “(Positive) self-monitoring” – athletes are asked to observe systematically (positive) various aspects of their performance and fill out self-monitoring sheets during breaks.	Research showed that skaters who monitored the number of elements they practiced during a training session were much more task focused and talking less during practices.
4. “Overlearning skills” – practicing (lifting) one's skill level over the competition challenge for that task.	It frees one's attention to other important aspects of the competition (e.g. tactical).
5. “Mental rehearsal prior to performance” – athletes are trying to imagine strategic aspects of the competition – getting a great start off the blocks, staying loose and relaxed, picture themselves solving problems during competition, etc.	Useful preparation technique that enhances and facilitates task- or process-oriented attentional focus.
6. “Using pre-performance routines” – players choose and then practice a sequence of simple activities that prepare them for competition.	Routines: 1. help athletes transfer their attention from irrelevant to task-relevant thoughts, 2. increase the likelihood that individuals will not get distracted internally or externally prior to and during performance, 3. allow the performance to stay automatic without the interference of conscious awareness.
7. “Competition plans” – athletes establish precompetition and competition plans of actions built around process goals (including alternative plans for different circumstances).	Planning facilitates attentional focus on the process of performance as opposed to factors over which competitors have no direct control, such as other competitors or final outcome.
8. “Shifting attention” – firstly the player is required to pay attention to what (s)he hears, then become aware of body sensations, then turn attention to his/her thoughts and emotions, etc.	Athletes become aware of their focus and learn to control and shift their attention consciously.
9. “Stick to a sport related object” – the player is required to sit in a quiet place watching a ball or puck and record for how long he can maintain focus on the object; once he is able to do it for 5 minutes he should also start practicing with distractions present.	Attention intensity and durability (long attention span) required. It is not easy to stay focused on one object. Players often experience their thoughts start to wander and they learn to monitor and bring them back to the object.

In the next group of attentional exercises that we analysed, which had been originally demonstrated by Weinberg and Gould [15], we found both already known ideas as well as innovative suggestions for improving attention. The latter are presented in the first part of Table 4. The authors point out to the disruptive influence of negative emotions on attention and suggest “Nonjudgmental thinking” as a means of preventing their occurrence. Then they stress the connection between concentration and the oculomotoric system, which should encourage athletes to control their eyes in order to have more control over their attention (Exercise 2, Tab. 4). It has been reported that having athletes monitor different, preferably positive aspects of their performance can make them more task focused [15]. Next, it is also necessary to point to the idea of “overlearning technical skills” (i.e. mastering them even beyond the requirements of the sport so that they become fully automatic), in order to make more attentional resources available for tactical purposes. Weinberg & Gould (Exercises 5-7, Tab. 4) suggest that the positive influence of routines and preparing competition plans as well as mental rehearsals on attentional processes during competition. All these techniques were also recommended by Winter & Martin [16] as well as several other authors [6, 7, 8, 11]. By the way, Winter & Martin also described an

interesting technique for improving concentration, which they called “performance segmenting”. It consists in dividing competition into meaningful parts (segments) – which in the case of a tennis match can be: sets, changes of ends, games or points – and setting fresh goals and plans for each segment in order to keep the focus on what is happening at the given moment [16]. This attitude is, according to Lloyd & Terry, also a typical attentional strategy used by elite rowers [9].

Exercise 8 in the table above demonstrates another idea for improving concentration by Weinberg & Gold: by asking the trainees to experience at first solely the visual stimuli, then listen carefully, then pay attention to kinesthetic, taste, tactile stimuli, and next pay attention to thoughts or emotions, the coach can make them aware of their focus and facilitate their learning to control and shift attention consciously.

Sticking to a single object (Exercise 9, Tab. 4) for a longer period of time makes another attentional challenge, because the attentional system naturally tends to wander, so athletes have to learn to monitor their thoughts and bring them back to the object, when needed.

Perhaps the most innovative of the exercises presented by Krawczyński & Nowicki [8] is the metaphor of spotlight (Exercise 1, Tab. 5), which can be used to help athletes understand the idea of

Table 5. Analysis of general attentional exercises suggested by Krawczyński & Nowicki

EXERCISE DESCRIPTION	ANALYSIS
<p>1. “Spotlight” – athletes learn to shift their attention (from the outside to the inside and vice versa) and change the scope of attention (broad-narrow) with the help of the following sequence of tasks:</p> <ul style="list-style-type: none"> • “light” the ball as well as all your teammates, • “light” all the tactical advice you received from your coach and imagine yourself implementing them, • “light” the spot on your neck, where you can feel the pulse, • “light” only the ball. <p>2. “Monitoring internal processes”, e.g. breathing.</p> <p>3. “Mantra” – repeating over and over again key words that are helpful for focusing attention.</p> <p>4. “Focus your eyes” – on the ball, floor, equipment, neutral stimuli (spot on the wall, a single tree in the background).</p> <p>5. “Concentrate on the present time”, focusing on current events with the help of key words and gestures, rituals, task-oriented thinking, non-judgmental thinking.</p>	<p>Increasing awareness of the direction and the scope of attention (developing attentional self-control), with the use of the metaphor “imagine your attention is like a spotlight”. Switching between:</p> <ul style="list-style-type: none"> • broad external attention (needed in team ball games), • broad internal attention (analysis, planning), • narrow internal attention (1 thought, 1 sense, 1 body part, 1 muscle), • narrow external attention (1 spot, 1 object, 1 detail). <p>Internal attention, focusing on the present events.</p> <p>Using words for managing attention direction – priming the mind for task-relevant objects or events.</p> <p>Trying to prevent the eyes from wandering to task non-relevant objects or events that could be absorbing the attentional resources and thus limiting the performance.</p> <p>Sticking to the current events prevents from thinking about the past (e.g. own errors, umpire mistakes, etc.) or looking ahead and thinking about the future, which often contributes to losing current points, games, etc.</p>

managing the scope and direction of attention. Then we can see already known ideas of monitoring internal physiological processes, repeating key words, controlling the visual focus and other techniques such as rituals, task-oriented thinking, non-judgmental thinking, which should help the athletes to “stay in the present time” and prevent them from typical sport specific distracters (thinking about the past events e.g. own errors, umpire mistakes, etc. or looking ahead and thinking about the future), which often contribute to losing points or games.

Among the many general attentional exercises we use by ourselves, we recommend especially those arranging a series of “attentional” traps for the trainees (Tab. 6).

A good example of this attitude constitutes the idea of “shifted counting” (included in Exercises 1-3) which does not permit reliance on automatisms [3]. We think that having to combine many activities or multiple actions at the same time (Exercise 3), or combining two and more activities requiring different rhythm at the same time (Exercise 4) as well as changing the rhythm of movements from time to time (Exercise 5) also needs activation of many cognitive resources, including attention. The last of the attentional tasks presented above consists in letting the athletes do a simple movement as slowly as possible, which requires great precision and is virtually impossible without achieving high attention intensity.

Table 6. Analysis of general attentional exercises used by Gronek & Schefke [unpublished]

EXERCISE DESCRIPTION	ANALYSIS
1. “Shifted counting” – the learner is counting from one to four, but each cycle of counting starts with a different (next adjoining) number, which means one should count: <ul style="list-style-type: none"> • 1-2-3-4, 2-3-4-1, 3-4-1-2, 4-1-2-3, 1-2-3-4 etc. instead of • 1-2-3-4, 1-2-3-4, 1-2-3-4, 1-2-3-4, 1-2-3-4 etc. 	The idea behind this unusual way of counting consists in setting a series of attentional “traps” for the player.
2. “Double counting” – while walking, the learner should count each step using “shifted counting” but at the same time (s)he should be aware of the total number of steps made, so he has to combine: <ul style="list-style-type: none"> • shifted counting: 1-2-3-4-2-3-4-1-3-4-1-2-4-1-2-3 etc. and • typical counting: 1-2-3-4-5-6-7-8-9-10-11-12-13-14-, etc. 	Combining three different activities: simple walking, counting steps in a typical way and counting steps in a “shifted” way.
3. “Many actions simultaneously” – “shifted counting” + specific leg movements + specific left hand movements + specific right hand movements + specific head movements.	Performing simultaneously a sequence of multiple independent moves with different parts of the body (i.e. head, arms, trunk, legs).
4. “Clockwise & counterclockwise” – the athlete is making circles with the index finger of the right hand clockwise but at the same time s(he) should be moving the other hand twice as fast counterclockwise.	Doing simultaneously two activities differing in rhythm.
5. “Combine two different rhythms” – participants are alternately clapping their hands and thighs, a person who has been called out immediately starts calling names, e.g. Tom-Tom-Tom-Jerry (three times one’s own name and then another participant’s name, who continues the procedure).	Doing simultaneously two activities of different rhythm: clapping hands and thighs (rhythm 1-2-1-2) and calling names (rhythm 1-1-1-2) or actively listening to another participant calling names.
6. “Changing the sequence of moves” – e.g. after three cycles of linear (forwards and backwards) steps the learner is supposed to do one cycle of turnaround steps and the whole procedure is repeated a few times.	Alternating between two different sequences of moves (linear and “angular”) – three cycles of sequence 1 are followed by one cycle of sequence 2.
7. “As slowly as possible” – the learner is supposed to cover a short distance (2-3 m) or stand up from a lying to upright position as slowly as he possibly can, without stopping the movement completely.	Precision requirements, focusing on the present events, kinesthetic attention.

ANALYSIS OF SPECIFIC ATTENTIONAL EXERCISES FOR TENNIS PLAYERS

Following a thorough analysis of the first two exercises presented by Bachmann & Meier [1] we can state that they set quite extraordinary demands for precision of movements (Exercises 1-2, Tab. 7). The next three tasks require additionally intense perception of a moving object, for example, the oncoming ball. Typical for this attitude is having the players attend to very small details of a sport specific object such as the seams of the ball (Exercise 3, Tab. 7), three black points painted on the ball [2], or numbers written on the ball [4].

After studying the last four suggestions made by Bachmann & Meier, i.e. playing the warm-up

with one ball only, starting games with the score 30:0 for one of the players, reducing the duration of a tennis match to ten minutes or even deciding the outcome of a tennis competition with one point only, we would expect that they have significant potential to influence the participants' attention, as they all bear meaningful and prompt consequences for the participants directly related to the level of their performance.

Probably the most comprehensive set of tennis specific attentional exercises was presented by Crespo, Reid & Quinn [4]. Because of the great number of suggested items we divided them into four groups. The first group includes tasks that can be used both in all basic tactical situations including match play (Tab. 8).

Table 7. Analysis of specific attentional exercises suggested for tennis players by Bachmann & Meier

EXERCISE DESCRIPTION	ANALYSIS
1. “Aiming at a 4-balls pyramid” – while hitting balls the players try to aim at a pyramid consisting of four tennis balls.	Precision requirements – aiming at a small target.
2. “Touch the net cord” – the players are asked to hit the ball in such a way that it touches slightly the net cord but does land on the other side of the court.	Precision requirements – aiming at a small target.
3. “Watch the seams of the ball” – while hitting balls the players try to notice a small detail on the ball (seams of the ball, letter or number written on the ball, etc.).	Perception requirements – watching very small items or details.
4. “Tic-tac” – players are asked to say the word “tic” exactly at the moment their partners hit the ball and the word “tac” just as they themselves hit the ball with the racket.	Precise timing of verbal actions (saying “tic” or “tac”) with the moment the moving ball contacts the partner’s racket or own racket is needed.
5. “Breathe out at impact” – the player should breathe out when hitting the ball.	Precise timing of exhaling with hitting the ball requires watching the ball more carefully than usually.
6. “Warm-up using one ball only” – instead of giving the players three or four balls (as usually), the coach lets them warm-up with only one ball.	Unpleasant consequences of making a mistake – when the ball goes out of play the players cannot just go on playing with another one, because they do not have any more balls– they need to go and fetch the ball to be able to resume play.
7. “30:0” – play a few games starting with 30:0 instead of 0:0.	Players start the game at a more advanced stage and are playing for high stakes – for player A, who leads 30:0, losing the game could bring shame, for player B who is 0:30 behind, winning the game could mean big honor.
8. “Short match” – playing a 10-minutes game or a tie break instead of a full span match.	Reduced competition time when compared to a full best of three sets tennis match requires extraordinary attention.
9. “Match point” – at any chosen moment of a training session the coach announces “playing a match point”, afterwards he goes on with the next exercise in his training schedule.	Playing for high stakes – winning or losing the match is decided with only one point.

Table 8. Analysis of tennis-specific attentional exercises used in all typical tactical situations

EXERCISE DESCRIPTION	ANALYSIS
<p>1. “Progressive scoring system” – players play points with the following scoring system: The first point played counts as 1 point. The 2-nd & 3-rd points played count as 2 points each. The 4-th & 5-th points played count as 3 points each. The 6-th & 7-th points played count as 4 points each. The 8-th & 9-th points played count as 5 points each. The tenth point played counts as 6 points.</p>	<p>The gradually increasing stakes mean the growing importance of subsequent points. Additionally the players need to do a lot of counting:</p> <ul style="list-style-type: none"> • need to control the general score of the match, • need to control the point value of subsequent rallies.
<p>2. “First to 30 strokes without losing the point” – the player, that wins the point retains the number of strokes he has made as his score, whereas the player, who loses the point returns to 0, e.g. if player A wins three points in a row hitting 10, 5, 3 shots respectively, his score would be 18; if he were to lose the next point he would return to zero and player B’s score would reflect the number of balls hit to win this point.</p>	<p>Stimulating the length of the attention span by requiring many subsequent successful task repetitions. Challenging attention capacity by the need to count subsequent successful shots. Increasing attention intensity through meaningful consequences (returning to zero points) of making a mistake.</p>
<p>3. „First to 100 strokes” – the player, who wins the point retains the number of strokes he and the opponent made during the rally as his score; the loser receives 0 points.</p>	<p>As above.</p>
<p>4. “First to 21 points or win 3 in a row” – players play a five set match, with each set being the first to 21 points, but if any player wins three points in a row, then he automatically becomes the winner of the set.</p>	<p>Players can never feel safe, because regardless of the general score of the match either player can win it with 3 subsequent points. Additionally players need to do a lot of counting: control the general score of the match and control the number of subsequent points won.</p>
<p>5. “Playing with different balls” – players rally with balls of different size, weight, color and material. variation: players play with rackets of different composition and size.</p>	<p>Perceptual demands. Challenging kinesthetic attention by having the players handle balls and rackets of variable (changing) parameters.</p>
<p>6. “Playing with earplugs” – players listen carefully to the sound of the ball bounce while playing, after 5 minutes they place earplugs in their ears and continue playing for further five minutes.</p>	<p>Perception requirements. Need to perceive (see) in more difficult conditions – without the helping function of the ears. Challenging the acoustic attention.</p>
<p>7. “Tennis ballet” – players simulate movements involved during point play focusing on the position of their bodies, their balance, how they accelerate and decelerate, the backswing, the forward swing, the follow through.</p>	<p>Stimulating the kinesthetic attention (increased control, awareness of own movements) by liberating the players from the need to watch the ball and opponents moves as well as from the need to hit the ball into a target. Can also be done with closed eyes.</p>
<p>8. “Shaded net” – while playing tennis the net is shaded with something opaque, which makes it difficult for players to find out what the opponent is doing.</p>	<p>Perceptual demands. Need to perceive the ball in more difficult than usual conditions, caused by the shade over the net. Challenging visual attention.</p>
<p>9. “Occluded vision” – the vision of one or both eyes occluded by wearing a cap, swimming or skiing goggles, one eye closed, looking directly into the sun, etc.</p>	<p>Need to perceive the ball in more difficult than usual conditions, caused by limiting the seeing function.</p>
<p>10. “Unfriendly background” – players practice against a backdrop (e.g. back fence that is painted many different colors) that is disrupting the visual processing of the ball.</p>	<p>Need to perceive the ball in more difficult than usual conditions, caused by the “unfriendly background”.</p>
<p>11. “Umpire” – players play points, before each point they have to alternately announce the score.</p>	<p>Need to keep (memorize) the score and follow the announcement sequence carefully.</p>

We claim that the first four exercises in Table 8 aim at keeping players' attention intensity high for prolonged time periods, whether it is by implementing the progressive scoring system, requiring many successful task repetitions, or setting a special rule that makes it possible to decide the outcome of a set with three successive points won regardless of the total score. In our opinion it is also worth noting that playing successfully with different balls and/or rackets does not allow to rely on automatisms and requires a higher level of attention than using always just the same, standard equipment. We suppose that the idea of letting players practice with earplugs is based on the widely known fact that excluding the function of one sense makes the other senses more sensible to stimuli. In tennis, excluding the hearing function should temporarily help increase the functioning of visual and kinesthetic attention.

Consequently letting players practice with closed eyes can increase the hearing and kinesthetic attention, which is probably the intention behind using Exercise 7 from Table 8.

We also found another interesting idea for challenging attention that consists in making the perception conditions more difficult than usual. For example, covering the tennis net with something opaque, occluding the vision of one or both eyes with different objects as well as playing against an extremely colorful background are three different techniques (Exercises 8-10, Tab. 8) that will set special challenges for players' visual attention.

Finally, by having players alternately announce the score a tennis coach can ensure, that they are fully aware of it, which in our opinion is particularly important in racket sports, characterized by frequent score changes.

Table 9. Analysis of tennis-specific attentional exercises used in baseline game

EXERCISE DESCRIPTION	ANALYSIS
1. "Two for you" – players rally with two balls at the same time.	Challenging attention capacity by introducing an extra ball (item) forces fast switching of attention between the two balls.
2. "Crossfire" – the coach feeds balls very quickly to player, who executes required shots (forehands or backhands or volleys or half volleys); additional technical or tactical tasks are possible.	Fast shifting of attention from one to another object (ball). Challenging attention capacity when combined with additional technical or tactical tasks.
3. "Hit each ball differently" – the player is supposed to hit balls using different spins (flat, slice, topspin), but is not allowed to use the same spin twice in a row (variation: instead of the spin of the ball the player has to control the speed, the height, the direction or the length of the ball).	Makes the player choose the spin of the shot carefully (according to the principle "in a different way then before"), requires to always keep in mind the spin of the preceding shot and make appropriate decisions.
4. "Mirror" – two players are supposed to hit balls using different spins (flat, slice, topspin), but player B has to use the very same spin as his partner A does (variation: player B has to use a different spin than his partner).	Makes the player choose the spin of the shot carefully (according to the principle "in a different way then the partner"), requires to always watch carefully and keep in mind the spin of the partner's last shot as well as make appropriate decisions.
5. "Strategic moments" – while playing tennis the player is supposed to focus on the moment: <ul style="list-style-type: none"> • the ball bounces on the other side of the court, • the opponent's racket contacts the ball, • the ball bounces on his own side of the court, • his own racket contacts the ball, and time (coordinate) his own verbal or motor actions accordingly. 	Need to watch carefully the strategic moments of the ball flight and adjust (precise timing required) own: <ul style="list-style-type: none"> • verbal actions: saying hip-hop, bounce-hit, prolonged yesss, • motor actions: making a split-step or exhaling, etc.
6. "Hit to a visualized target" – players are hitting shots to strategically placed targets, then the coach removes the targets and asks the players to visualize the target positions while continuing to play.	Aiming at a target: <ul style="list-style-type: none"> a. that is precisely and vividly marked, b. after the marking has been removed – having to memorize and visualize the marking.
7. "Colorful tennis" – the coach is feeding balls of different colors from the basket, red balls are to be hit down the line and yellow balls crosscourt.	Need to make correct decisions concerning the shot direction upon the color of the oncoming ball (selection criteria).

An analysis of the next group of attentional exercises suggested by Crespo et al. [4] is presented in Table 9. They can be used mostly in tennis baseline game situations and seem to challenge players' attention in many different ways: by playing two tennis balls at the same time instead of one (Exercise 1), by playing many balls fed in quick succession one after another (Exercise 2), by having to change the spin of the ball according to a

changing pattern (Exercise 3), by the need to copy the spin of the shot chosen by the opponent or consciously use a different one (Exercise 4), by having to emphasize some strategic points of the ball flight (Exercise 5), by the need to visualize and memorize the target marking (Exercise 6), or last but not least, by forcing the player to make fast and correct decisions according to precisely set criteria (Exercise 7).

Table 10. Analysis of tennis-specific attentional exercises used in serves and serve returns

EXERCISE DESCRIPTION	ANALYSIS
1. "Half volley returns" – instead of standing near the baseline (as usual) the receiver moves to the service line which reduces the distance between him and the server by about 5 meters.	Reduced distance between players shortens the reaction time, high speed of the served ball brings another challenge for the receiver's attention. Perception & anticipation demands.
2. "Anticipate the return direction" – player A is serving and player B is returning; prior to the return player C (who is standing behind player A) has to indicate the return direction (e.g. return to the right – hand to the right, return to the middle – closed fist, return to the left – hand to the left, return outside – hands up).	Need to anticipate, visual attention. Scoring system: right anticipation "+ 5 points", no anticipation "- 1 point", mistake "- 3 points".
3. "Anticipating serve direction I" – the receiver B's teammate C (who is standing behind him) has to indicate the serve direction of player A before the oncoming ball crosses the net; the team earns points both for winning the rally and correct indication of the serve direction.	Need to anticipate, visual attention. Scoring system.
4. "Anticipate serve direction II" – the receiver B's teammate C (who is standing behind him) has to indicate the serve direction of player A before he even hits the ball; scoring: correct anticipation "+ 5 pts.", no anticipation "- 1 pts.", incorrect anticipation "- 3 pts."	Need to anticipate, visual attention. Scoring system.
5. "Anticipate the serve spin" – the receiver B's teammate C (who is standing behind him) has to indicate the serve spin of player A before he even hits the ball; the team earns points both for winning the rally and correct indication of the serve spin.	Need to anticipate, visual attention.
6. "Bullseye" – 3 circles (circle diameter adjusted to the standard of the players) are drawn in a service box, after successfully hitting the circle players are rewarded with points.	Precision demands. Aiming at a small target, narrowing the focus.
7. "Marked balls" – balls are marked with numbers from 1 to 3, the returning player has to read the mark and place the ball accordingly, e.g. 1 – into the left corner, 2 – down the middle, 3 – into the right corner.	Perception requirements – need to notice a small detail on the ball. Also correct decision making required.
8. "Listen to the spin ... carefully" – player A randomly alternates 20 flat, slice and topspin serves; player B who is facing the back fence, should listen to the sound of the ball and racket at contact and call out the type of serve that has been hit.	Sharpening acoustic attention by excluding the seeing function.
9. "What's the pattern?" – the coach makes 10-15 serves (or returns) according to a freely chosen pattern, e.g. twice to the forehand, once to the backhand (2-1-2-1) or more difficult (4-3-2-1) – the player has to recognize the pattern.	Need to memorize the direction of a series of serves/returns.
10. "Four shots game" – players play points not lasting longer than four shots; if any point extends beyond the serve, return and the next 2 shots, it is replayed.	Need to focus attention on first two shots (i.e. either a serve or a return and the following shot, respectively).

We suggest that when tennis players are receiving balls, one of the main external factors which seems to stimulate their attention are the anticipation requirements. The need to anticipate makes the player look for specific details or the slightest hints or signs that will allow him to foresee future events (like, for example, the direction, length or spin of the oncoming ball) and therefore usually increase his level of attention (Exercises 1-5, Tab. 10).

Other ideas for activating attention include setting precision demands (Exercise 6), forcing the trainees to watch for small details, e.g. specific

marks painted on the ball, or an already known idea of excluding one of the cooperating senses (Exercise 7). A very interesting concept for increasing attention in sports situations could be the need to memorize certain strategic aspects of performance. In tennis, it could be memorizing the direction of the last four serves made by the coach or practice partner as in Exercise 9. We assume that the last exercise from Table 11 aims to increase attention by deliberately limiting the number of shots allowed for each of the players to two. The reduced number of shots and automatically also the limited time of play should make players more

Table 11. Analysis of tennis-specific attentional exercises used for playing at the net and passing the net player

EXERCISE DESCRIPTION	ANALYSIS
1. “Searching for cues to anticipate direction” – player A positioned on the baseline, receives a short ball fed by the coach, he plays an approach shot to one of the corners of the court and tries to anticipate player B’s passing shot, indicating to the coach where he is focusing (e.g. player B’s grip, court position, etc.).	Need to anticipate the direction of the opponent’s shots as well as the need to search for and point out the anticipation cues.
2. “Anticipate the lob” : player and coach play a series of volleys and half volleys, at any given moment the coach can surprise the player with a lob.	Need to anticipate a specific action (i.e. the lob) of the coach and quickly react to it adequately.
3. “Follow the ball to the net and play max 2 shots” with the following scoring system: attacking player – winning volley 2 points, keep the ball in play 1 point, defender – winning passing shot 2 points, winning the point with the second passing shot 1 point.	Need to focus attention on just two shots. Because player A is coming to the net – the distance between players is shortened (when compared to the situation when both play from the backcourt), which means less time for reaction for both players.
4. “Fast volley exchanges” – players participate in fast volley exchanges near the net.	Reduced distance between players (compared to playing from the backcourt) combined with high ball speed, shorten the time for reaction, make the players hit far more frequently and move their eyes (switch attention) a lot.
5. “Net covered with a shade II” : the coach hand feeds balls to the players, who have to sprint from behind the baseline and play the ball back after the first (or second) bounce.	The shade over the net prevents the players from seeing the hand of the coach – increased perception requirements when compared to normal conditions.
6. “Net covered with a shade III” – player A is standing at the net and hits deep, short and angled (half) volleys; player B is trying to play the ball back to player A).	The shade over the net makes the player B unable to see what shot is being played by player A – increased perception requirements when compared to normal conditions.
7. “Turn around hearing the sound” – player faces away from the coach, who stands at the other side of the court; hearing the racket-ball contact, the player turns around, reacts to the ball fed by the coach and tries to hit it back with a volley.	Sharpening the acoustic sense by excluding the seeing function.
8. “Surprisingly fed extra ball” – player A is at the net and player B is at the baseline, they rally cooperatively, the coach feeds randomly and intermittently an extra ball to player A, who has to play it back (volley, smash, half-volley) while continuing to rally with player B.	Need for controlling two additional objects (the coach and the extra ball) is challenging attention capacity and peripheral visioning. It also requires fast switching of attention.

Table 12. Analysis of tennis-specific attentional exercises used in the playing time by Gronek & Schefke [unpublished]

EXERCISE DESCRIPTION	ANALYSIS
1. “Watch the ball, the opponent, the environment” – while playing tennis the player alternates between watching solely the ball, then controlling both the ball and the opponent and eventually trying to see the ball, the opponent and everything that is happening around.	Switching from a narrower to broader focus. Making the players aware of their scope of attention while playing.
2. “Scalped ball” – the coach removes one half of the felt from the ball(s) and lets the trainees play tennis with this “scalped ball”.	Because of the partially torn felt there will be many unpredictable ball bounces, which increases the perception requirements and thus makes the players concentrate more.
3. “Can catching” – the coach is standing on the baseline feeding balls from the basket, the player is standing on the service line on the other side of the court trying to catch the balls with a ball can.	There are increased perception and precision requirements because of the small diameter of the can entry.
4. “Frame juggling” – the player is holding his racket like a hammer and bouncing a tennis ball with the racket frame instead of the racket face.	Precision and perception requirements – reduced size of the hitting object.
5. “Basketball or baseball tennis” – instead of using a tennis racket to hit balls fed by the coach the player is hitting them holding a basketball or a baseball bat.	Reduced size of the hitting object (basketball or a baseball bat vs. tennis racket) increases perception and precision requirements.
6. “Machine gun” – the coach is standing on the baseline and fires (feeds at a very high speed and frequency) balls from the basket aiming at the player’s body; the athlete, who is standing at the service line on the other side of the net has to volley the balls back.	Perception requirements – extremely high speed of the oncoming balls fed in quick succession. The risk of getting hurt when not attentive enough.
7. “Watch the coach” – the coach feeds balls emphasizing different aspects of technique; the player has to observe the coach’s moves and copy them, e.g. use the same stroke (forehand or backhand). Variation: the player has to use an opposite technique.	High perception requirements – seeing small details from a long distance. There are many possible variations: high or low hitting point, open or closed stance, short or long backswing, high or low loop, big or small leg drive, big or small shoulder turn, etc.
8. “Closing eyes” – while playing tennis the player has to alternate between closing the right and left eye.	Increased perception requirements – watching the ball only with one eye.
9. “Self-umpiring” – player is practicing forehands and backhands with the aim of hitting the backcourt area, every time he misses the target he should call “out”, if he is wrong he loses the point.	Increased perception requirements – the need to make correct judgments from a long distance.
10. “Anticipate the miss” – two players are practicing forehands and backhands with the aim of hitting the backcourt area; every time the player feels the opponent’s shot is going to miss the target he should call it “out”, but well in advance (before the ball lands on the court); if he is right he wins the point, if he is wrong he loses the point.	Increased perception requirements – the need to make correct judgments in advance (anticipate) and from a long distance.
11. “Demanding shot sequence” – players hit balls down the middle of the court standing behind the baseline using one of the following patterns: <ul style="list-style-type: none"> • 1fh-2bh-3fh-4bh-5fh-6bh-7fh-8bh-9fh-10bh, • 10fh-9bh-8fh-7bh-6fh-5bh-4fh-3bh-2fh-1bh, • 1fh-1bh-2fh-2bh-3fh-3bh, • 3fh-3bh 2fh-2bh 1fh-1bh. 	Altering forehands and backhands according to a set, relatively difficult, sequence of shots. There are countless possibilities of variations, e.g.: <ul style="list-style-type: none"> • 1fh-2bh-3fh-1bh-2fh-3bh, • 1fh-2bh-2fh-1bh-1fh-2bh-1fh-2bh-1fh-2bh, • 1fh-2bh-3fh-3bh-2fh-1bh, • 1fh-1bh-2fh-2bh-1fh-2bh-2fh-1bh.
12. “Tennis with shifted counting” – the learner is counting from one to four, but each cycle of counting starts with a different (next adjoining) number: • 1-2-3-4, 2-3-4-1, 3-4-1-2, 4-1-2-3, 1-2-3-4 ... etc. Each time the number is “4” he should hit a backhand, otherwise it should always be a forehand.	Still another difficult shot succession sets a series of attentional “traps” for the player.

focused on the beginning of the point when compared to the situation, when they expect an unknown (unlimited) number of shots.

A common feature of all attentional exercises developed for playing at the net and passing the net player [4] presented in Table 11 is the reduced distance between players (when compared to the situation when both players play from the backcourt) – because one or both players come closer to the net. It automatically means reduced time for reaction and greater need for anticipation skills.

We think that the coach can additionally challenge athletes' attention by making the perception of oncoming balls even more difficult when: having both players hit fast balls (Exercise 4), covering the net with something opaque (Exercise 5-6) or by having the players react to the sound of the ball only (Exercise 7). It seems that a special challenge for players' attention capacity can be introduced by occasionally feeding a second, extra ball into play (see Exercise 8).

Now we will present a couple of our own suggestions for raising the level of attention in training exercises as well as managing the focus of attention during play and breaks in play. Let us start

with the idea of making the players aware of their scope of attention while playing, during warm up first and then also during regular training exercises (Exercise 1, Tab. 12).

Exercises 2-9 (Tab. 12) involve several ideas for increasing perception and/or precision requirements in tennis training; Exercises 11 and 12 (tab. 12) aim at increasing tennis players' attention by having them to follow a strict sequence of shots.

Another group of tasks (Exercises 1-3, Tab. 13) should, first of all let, players experience different focus types during breaks in play: narrow and broad, associative and dissociative, focusing on the past, present or future events. It should let them develop the awareness of their focus style as well as help them consciously manage their focus in the most effective way.

The idea of differentiating the number of ball bounces (or any other elements of the preparation ritual performed just before serving or returning in tennis) according to the side of the court (Exercise 4, Tab. 13), can be used to help players focus on current, emotionally neutral aspects of performance rather than on future or past, emotionally challenging things.

Table 13. Analysis of tennis-specific attentional exercises used in dead time Gronek & Scheffe [unpublished]

EXERCISE DESCRIPTION	ANALYSIS
1. “Narrow & broad focus during breaks” – players play a practice set, during breaks between the points they have to alternate between broad focus (trying to see and hear everything around them) and narrow focus (trying to keep the focus inside the court area).	Conscious switching from narrow to broad focus.
2. “Associative & dissociative focus during breaks” – players play a practice set, during breaks between the points they have to alternate between associative focus (trying to think about the game) and dissociative focus (thinking about school or home affairs).	Conscious switching from associative to dissociative focus.
3. “Past, future and present focus during breaks” – players are asked during breaks to alternate thinking about the past, future and present events, by having to answer the coach's questions: What were you doing before practice? What are you going to do after practice? What are you doing right now?	Conscious switching from focusing on the past, on the future and on the present events.
4. “Odd & even number of ball bounces” – while preparing to serve to the deuce court the player should bounce the ball an odd number of times, whereas while serving to the ad court he should bounce the ball an even number of times.	Focusing attention on a (typical for tennis) part of a preparation ritual. Ball bouncing can be also replaced by other elements, e.g. blowing air in the hand, taking breaths, making jumps on place, etc.

CLASSIFICATIONS OF ATTENTIONAL EXERCISES

The great number of suggested exercises and ideas on improving attention in sport calls for making attempts to categorize them in a systematic way. We suggest the following criteria for classification of attentional exercises: the phase of the game, the attentional abilities (skills) emphasized, the senses involved, the object(s) of attention and the action(s) involved.

Classification based on the phase of the game

Managing attention during actual competition time and during breaks in competition should be two different things, because intense concentration needed for performance is very energy consuming [2]. Therefore we recommend distinguishing between exercises improving concentration in the competition time and in the “dead time” (during breaks).

Depending on the specific requirements of the given sport, attentional exercises in the playing time can be further divided according to various criteria. One of them could be the tactical situation in the game. In the case of tennis we can think about attentional exercises for serving, for returning, for playing from the backcourt, for attacking to the net and for defending (the situation, when the opponent is attacking to the net) and finally for the regular match play (complex tactical situation).

Attentional exercises in the dead time can also be further divided, for example, according to their function: reaction to the outcome of the previous point, relaxation, raising arousal, direct preparation for the next point, etc.

Classification based on the emphasized attentional ability

Coaches may also be willing to emphasize development of various attentional abilities. Thus it will be useful to look for and differentiate between exercises: best suited for raising attention intensity, particularly useful for improving attention capacity, aiming specifically at attention shifting or striving mainly for improvements in attention durability.

For example, raising attention intensity can be achieved through innovations, precision demands, decision making requirements, reaction and anticipation demands, (ball) tracking

requirements, including potential risks and gains of (un-)successful performance for participants, or having them to consciously increase and decrease the intensity of attention.

Other elements should be stressed when a coach is aiming for developing attention capacity, e.g. increasing the number of objects attended to, increasing the number of actions attended to, increasing the size of the area that needs to be controlled, increasing the number of selection criteria for decision making, increasing the number of decision options to choose from. And finally the coach may want the athletes to consciously narrow and broaden the scope of attention.

When aiming for developments in attention shifting one should look for exercises requiring different types of shifting (from one to another object, from one to another sense, from one to another area, from one to another action, from one to another activity) and speed of shifting.

When developing attention durability coaches may need to increase requirements for the duration of error-free performance or increase the required number of successful repetitions: its overall number, number of successive successful repetitions, number of successful repetitions in a given time or the percentage of successful repetitions.

Classification based on the senses involved

As different senses can play a more or less decisive role in various sports it will be beneficial to distinguish and work on developing: visual attention exercises, kinesthetic attention exercises, auditory attention exercises, taste attention exercises (actually of minor importance in sport), smell attention exercises (basically having no role in sport), and finally multisensual attention exercises.

Classification based on the object of attention

First of all it is necessary to have a more general differentiation between external, internal and combined internal-external attention exercises.

It should encourage specialists to look for important external objects in any given activity. Specifically for tennis we suggest: ball oriented attentional exercises, racket centered exercises, opponent related attentional exercises as well as exercises increasing court, net or score awareness.

As far as internal attention is concerned we recommend two groups of exercises: those focusing on athlete's body movements and another one – requiring focus on the physiological processes of the body. Exercises demanding concentration on one's own body movements can emphasize: temporal parameters like the moment one starts the backswing or hits the ball; spatial parameters like the way one grips the racket, swings the racket (in which direction), or places the racket head (at what angle), also footwork, trunk or arms movements; dynamic parameters like the speed of the movements or the power generated by the muscles.

Among the basic physiological processes to concentrate on one should list: breathing, heart rate, muscle tension, mental images, thoughts and emotions. And last but not least we should not forget that there will be also numerous exercises requiring both internal and external attention at the same time.

Classification based on the type of action involved

Instead of having the object as the main criterion of classification, some practitioners may prefer group attentional exercises according to the type of action involved. Again in the case of complex activities (like playing tennis) it is necessary to define all important actions first. Specifically for tennis we found: perceiving the ball, making decisions, moving (running, jumping) to the ball, hitting (sending) the ball, controlling own position in relation to the court, attending to the target, attending to the net, attending to the opponent and controlling the score as basic actions needed for successful play. Therefore we propose to work on and develop attentional exercises for each type of the actions listed above as well as for the complex activity of playing tennis.

Classification based on the dominant type of activity

We suggest differentiating attentional exercises according to the dominant, i.e. most challenging part of activity into: perception, processing and executive attention exercises.

If the task includes demanding perception conditions, but there are not any advanced thought processes and there are no moves or the moves are relatively easy and simple (like in the case of pressing the keyboard in computer games), then one should speak about perceptive attention

exercise. Processing attention will be mostly needed when there are demanding advanced thought processes, like for example, mathematical operations, analysis, synthesis, comparisons, recalling, memorizing, imagining, decision making, etc. with perceptual and motor demands of minor or no importance. Finally, if the task requires precise movements (executed with famous “surgical precision”) or complex movements (e.g. moving arms and legs independently when playing the drums) or high performance movements (according to the Olympic motto: “Faster, Higher, Stronger ...”), then it is necessary to have a high level of executive attention. Needless to say, in many cases there will be all three types of attention involved.

The aforementioned analyzes have also enabled us to identify several general factors stimulating attention.

FACTORS STIMULATING ATTENTION

We posit that the main factor which is typically used for activating attention in sports settings is the need for successful (error-free) task performance, usually combined with current feedback on the level of performance. In order to challenge performers' various attentional skills coaches can also use exercises that:

1. set tasks requiring fast reaction and/or anticipation (e.g. Exercises 1-4, Tab. 1);
2. require the athletes to make appropriate decisions based on the adequate situation assessment (e.g. Exercises 1-4, Tab. 1);
3. require correct execution of two and more actions at the same time (e.g. Exercise 2-5, Tab. 6);
4. let the trainees aim at small targets (e.g. Exercises 1-2, Tab. 7);
5. make the players notice small details of a sport specific object (e.g. Exercise 3, Tab. 7; Exercise 7, Tab. 10);
6. have athletes monitor internal processes: breaths, heart beats, thoughts, emotions (e.g. Exercises 1, 3, 6, Tab. 2; Exercise 2, Tab. 5);
7. let players monitor external events: strokes, passes, moves, etc. (e.g. Exercise 3, Tab. 4; Exercise 9, Tab. 10);
8. require control of the speed and (or) rhythm of movements by having the people move as fast as possible or as slowly as possible as well as

- adjust to an external rhythm, music, beat (e.g. Exercise 7, Tab. 6);
- 9. require frequent and (or) fast shifts of attention (e.g. Exercise 8, Tab. 4; Exercise 2, Tab. 9; Exercise 4, Tab. 11; Exercises 1, 6, Tab. 12);
- 10. need searching (e.g. Exercise 3, Tab. 3);
- 11. do not allow for automatic actions because of a variable rhythm of actions (e.g. Exercises 4-5, Tab. 6), variable sequence of actions (e.g. Exercise 6, Tab. 6), untypical scoring system (e.g. Exercises 1-2, Tab. 6),
- 12. turn out one of the supporting senses (Exercise 4, Tab. 2; Exercises 6-7, Tab. 8; Exercise 8, Tab. 10; Exercise 7, Tab. 11);
- 13. expose athletes to distractions (not relevant stimuli) while performing tasks and ask them to keep the appropriate level of performance (Exercise 5, Tab. 2; Exercise 10, Tab. 4).

It should also be pointed out that certain preparatory activities – employed before starting or resuming the main activity – help to direct as well as increase and keep the right intensity of attention. Here one should mention:

- 1. focusing the eyes on a single point (Exercise 2, Tab. 4; Exercise 4, Tab. 5),
- 2. using task-related words or phrases (e.g. Exercise 10, Tab. 3; Exercise 3, Tab. 5),
- 3. using preparation rituals (e.g. Exercise 6, Tab. 4),
- 4. using visualization (e.g. Exercise 5, Tab. 4; Exercise 3, Tab. 5),
- 5. preparing action plans for different circumstances (e.g. Exercise 11, Tab. 3; Exercise 7, Tab. 4),
- 6. thinking about the task at hand (e.g. Exercise 12, Tab. 3),
- 7. neutralizing distracting thoughts (e.g. Exercise 7, Tab. 2).

The analysis presented above, including the knowledge about the factors activating and directing attentional processes, has helped us to formulate several principles for developing exercises with the goal of improving attentional skills.

PRINCIPLES FOR IMPROVING ATTENTIONAL SKILLS

Principle of setting measurable performance goals

When constructing measurable goals the coach firstly needs to *define the task and set quality criteria* for its successful performance. The tasks

given by sports coaches are all sorts of different actions, such as making runs, jumps, throws, shots, passes, saves, catches, spikes, steals, rebounds, assists, lifts, blocks, etc. The criteria for their successful performance usually refer either to technical correctness (e.g. bend the knees up to 90 degrees, stretch the arms over your head, turn the shoulders sideways to the net, etc.) or tactical effectiveness (e.g. score a goal, jump over a bar, pass the ball to a teammate, hit the target, run a certain distance in set time, lift a bar weighing X kg, etc.).

Secondly, it is necessary to set the *desired number (or percentage) of successful task repetitions*. The coach may want his pupils to do something once, twice, 10 times, 100 times ... etc. or maybe as many times as possible. If the coach requires more than one successful task repetition, he should also consider whether he wants them to happen consecutively, e.g. 20 successive successful basketball free throws, 10 successful lifts of a weight bar in a row, 5 consecutive accurate passes in a soccer game, etc.

Then we should define the *number of attempts* or errors (consecutive or not) allowed. This is easy to understand if we consider that an army sapper has always only one attempt and is not allowed to make any errors (or he loses his life), a tennis player when serving has always two attempts and is not allowed to miss the target twice in a row (or he loses the point), whereas for high jumpers or pole vaulters three successive errors are not allowed (or they get eliminated).

Combining those two variables we can also define the task by setting a desired *percentage of successful task performances*, such as 8 out of 10 (80%) volleyball jump serves need to be in, or 5 out of ten (50%) of shots on goal must be saved by a handball goalkeeper.

Last but not least, the coach has to decide if there will be any *time constraints*. (S)he may want the students to fulfill the task in precisely set time: in a 40-min basketball game, in a 60-min hockey game, in a 90-min match or training time, in 1 minute exercise time, in a 10-month league season, etc. A more flexible option is to have the athletes do something in “reasonable” time: complete a marathon run or Ironmen event in reasonable time. Other ideas could be doing something in shorter time (i.e. run 100 meters distance in shorter time than personal best) or in longer time, for example, being able to cycle

continuously with a set speed for a longer time than the day before. The two remaining options are having the athletes do something in the shortest time possible or for as long as possible.

The attentional demands of the goals set for athletes, depend among other things upon the precision requirements of the task.

Principle of high precision requirements

The coach can increase attention intensity if he sets precision demanding tasks, preferably superior to the requirements of the sport. One should differentiate between spatial, temporal and dynamic precision.

Spatial precision demands are set first of all by reducing the target size for the “shooter”. In soccer, it could mean practicing shots at the goal post, goal bar or a small target placed in the goal. In tennis, the most popular precision tasks (targets) are trying to hit: only one half or one third of the court, only the back part of the court, the doubles alley, a small plastic bottle, a little cone, a ball can, a court line, the net cord, a 4 ball pyramid, an A 4 format piece of paper, a handkerchief, etc. Increased spatial precision demands could also mean reduced size of the objects used, e.g. having a gymnast walk on a tight rope instead of walking on the beam, having a volleyball player hit balls with only one instead of two hands, having a soccer player juggle a tennis ball instead of a soccer ball, having a tennis player hit balls with a baseball stick instead of a tennis racket or bounce a ball with the racket frame rather than with the much bigger racket face, also having handball players use only one hand for catching, or having tennis players catch balls into a tennis ball can, etc.

In timed events (running, swimming, rowing, canoeing, etc.) it would be more advisable to set temporal precision demands, like having to cover a distance in a set time range or slower (faster) than the previous one with the time difference being as small as possible, or cover a set distance as slow as possible without stopping the movement.

In jumping, throwing and hitting events we could think of setting dynamic precision demands, like hitting or throwing a ball with a set velocity range (measured by a radar gun), applying set power or gradually increasing power when squeezing a hand dynamometer or jumping off a platform (controlled by jump measuring device).

The difficulty of the task and its attentional requirements can be also controlled by including perceptual demands.

Principle of high perceptual demands

There are several possibilities of integrating perceptual (and attentional) demands in a task. Among other things it is possible by having the trainees *watch a moving object*. It is already the case in all sport games, but worth noting, it becomes even more challenging with the *increasing speed* of a ball, shuttlecock or puck. This makes some tennis coaches feed balls for their pupils with extreme speeds or let them face more powerful strokes of their older and stronger training partners.

If we also *reduce the distance* between players (or coach and player) then we leave so little time for reaction that it requires the athlete to show extraordinary anticipation and attention skills to perform the task. Typical ways of reducing the distance between players in tennis are having one or both of them stand closer to the net than usually, e.g., have one player serve from inside the court and/or the other one make returns from inside the court, have one of the players run forward (attack) and close the rally at the net or setting fast volley exchanges with both players standing close to the net. One more example of this attitude could be having a player stand 1 meter in front of a wall and catch balls hit against the wall by the coach.

Coaches can also have the athletes deal with the so-called “*bad bounces*” and *ball ricochets* on a regular basis to increase their attention. It can be done by exercising (catching, hitting) with balls of “irregular” shapes (rugby ball, ricochet ball, tennis ball with damaged surface – partially torn felt) or exercising with regular balls bouncing off totally uneven surfaces of the field or the wall or even having a person stand in front of an exercising player (e.g. goalie) and occasionally deflecting the oncoming balls.

We can also increase perceptual demands in several other ways. For example, it is possible to *occlude the vision* of the oncoming ball by having the exercising players wear a cap, sunglasses, swimming or skiing goggles, close one eye, temporarily close both eyes, turn around for a while, face an extremely colorful background, by putting a dark cover over an otherwise transparent tennis (volleyball, badminton, etc.) net, waving a racket (flag) or having someone run (jump) in front of the receiving player, and so on.

There are still more possibilities of increasing perceptual demands to come. Among others it could be *reducing the size of the moving object* (e.g. having tennis players deal with smaller ping pong or squash balls or having soccer players deal with miniature soccer balls or tennis balls), requiring the athletes to *notice small details of the moving object* (e.g. having tennis players notice the seams of the ball, a number or a letter put on the ball) or by *limiting the cooperating senses function* (e.g. limiting the hearing function by working in noisy conditions or applying earplugs, limiting the tactile function by putting gloves on the player's hands, limiting the helping function of vision by exercising with the closed eyes, etc.).

Another option for increasing attentional demands of a task is requiring the athletes to make correct decisions.

Principle of demanding correct decision making

Coaches need to define the choice options available for the players and the selection criteria that should be used. Let us consider an example in which there will be two options of shot direction (crosscourt or down the line) with the color of the oncoming ball as the selection criterion: When the tennis coach is feeding a yellow color ball the player is supposed to hit the ball crosscourt, and if a different color ball (e.g. white or red) is fed then it is necessary for him to hit it down the line.

Other typical tactical choice options for tennis players are the length, height, spin and velocity of the ball, whereas the characteristics of the oncoming ball constitute basic selection criteria¹.

The decision making demands determine in some way the attention capacity requirements of the task at hand.

Principle of increasing attention capacity demands

Coaches should gradually increase the number of objects a player must perceive or the area they should control and/or the number of actions players have to execute simultaneously.

In ball games it could mean increasing the number of perceived objects: playing with two balls (shuttlecocks, pucks) instead of one; or having 4 goals (baskets) instead of two or playing basketball

6 against 6 (an increased number of teammates and opponents).

An interesting example of increased attention capacity demands is bandy, as compared with regular ice hockey. Bandy (also known as Russian hockey) is played on a soccer field (105 meters long and 68 meters broad) and each team consists of 11 players, whereas in ice hockey we have teams consisting of 6 players playing on a 61 meters long and 30 meters wide ice rink. So in this case we have both an increased number of objects (players) and a larger field to cope with.

Another idea for increasing the attention capacity demands could be playing two different games at the same time instead of one. Let us imagine two teams playing simultaneously soccer and handball on a handball field, having to kick the first ball and use hands only for the second one as well as respect other game rules respectively!

Principle of forcing attention shifts

The attention capacity demands also determine the need for attention shifting. Coaches should take into account many different possibilities of forcing quick and/or frequent attention shifts. They may require the athletes *to shift attention from one object to another*, e.g. from one to another ball, from one to another opponent, from one to another teammate, from a ball to an opponent, from an opponent to a teammate, from one to another target from one field to another. They may also differentiate between shifting attention from internal to external objects.

Different examples of attention shifting include *altering between various* (often contradictory) *actions*, e.g. catching and throwing, blocking and kicking, pulling and pushing, running and stopping, serving and returning, bending and jumping, attacking and defending, sending and receiving or changing between various systems of play (e.g. between defense systems 6-0, 5-1, 4-2 in handball). A very similar task appears to be the changing between different ways of execution: slow and fast, hard and soft, high and low, short and long, big and small, topspin and backspin.

A special kind of attention shifting may represent changing the scope of attention from a smaller to a bigger object (small and big ball), area (smaller and larger field of play) or from fewer to more objects or actions. A good example of the latter would be alternating frequently between playing 2 against 2, 2 against 3, 3 against 2, 3

¹ For other typical choice options and selection criteria in tennis see [14].

against 3 and so on, during an ice hockey training session.

In order to achieve the best possible results from different attentional exercises (tasks) it is important to arrange them in a sport specific setting.

Principle of sport specific environment setting

It requires the coach to include in the tasks set for athletes sport specific objects and actions, in typical tactical situations, in the presence of specific distracters.

In the case of tennis the *objects* players should be paying close attention to include the ball, the net, the court, the racket, the opponent, the score, and themselves. Moreover the tasks should include cognitive and motor *actions typical* for tennis: perceiving, decision making, moving around the court (running, jumping, sliding, stopping, etc.) and executing strokes (forehands, backhands, volleys, smashes, etc.). They should be arranged in *typical tactical situations* which are: player is serving, player is returning, both the player and the opponent play from the backcourt, player is approaching the net or the opponent is approaching the net.

Principle of getting used to typical distracters

A sport specific setting should also include common distracters for the sport. Because of the significance of staying focused despite many potential distracters we see the need for another principle of constructing attentional exercises. The coach is required to look for sport (or player) specific distracters and then include them regularly in daily practice. It is not surprising that the biggest group of distracters consists of *visual stimuli*: intense arena lighting, flash lights, the presence of the audience, line judges, ball boys, parents, boyfriend, TV cameras, club/state president, famous actor, pop star, etc., people in the audience moving (appearing, disappearing), opponent's untypical movements (Do you remember the "Dudek dance" or Grobbelaar's tricks?) and positioning, and many more.

The second group of distracters includes *auditory stimuli*: people talking loudly, shouting, whistling, loud speaker announcements, opponent's nasty remarks (Do you remember the Materrazzi-Zidane case?), trains passing nearby, planes flying overhead. We can also think of possible *tactile and*

kinesthetic distracters such as a high level of tiredness after endurance training or impaired coordination after weight training.

Principle of meaningful consequences

Regardless of the nature of the task given to players, the performance level that the athletes achieve should have meaningful consequences for them. Setting measurable performance goals is almost inherently combined with meaningful consequences of the successful or unsuccessful outcome of the activity, provided the trainee becomes (or may expect to become) ongoing, or post performance feedback on the level of his/her achievements is given to him. The feedback can take the form of a note (good or bad, passed or failed, better or worse), information on lap or race time, calories burnt, power output, speed of shot, distance of throw, height of jump, information about well-aimed and missed shots, etc. The consequences become even more significant if we are able to increase the potential risks and/or gains (rewards) for the athlete. Coaches can do it either in a symbolic or a material way. The potential risks of unsuccessful performance could be losing a bet, losing competition (coming second best, coming last), losing a point, game, set or match, getting penalty points, getting penalty tasks (extra laps, push-ups, sit-ups, etc.) getting eliminated, losing a virtual life (as if in a computer game), wasting an opportunity, wasting money, time and effort, getting hurt or injured (in boxing events, martial arts, high speed races), facing social disapproval, etc.

The potential gains are winning bets, competitions, points, games, sets, matches, trophies, financial awards, material rewards (sweets, drinks, accessories), social acknowledgements (applause, congratulations), being promoted (to the next level, round, league) being selected (for a team, club, national squad), earning bonus points, extra time or extra life (as if in a computer game), seeing others do penalty tasks (shaving head, dye one's hair blond or red, jumping into water in clothes, singing a song, telling a joke, etc.).

Thus a clear message for coaches wanting to increase their players' attention is (apart from taking part in official competition) to introduce various scoring systems in training exercises, announce awards and/or penalties for successful or unsuccessful training performances, arrange betting, organize competition, etc.

Among various ways of enhancing players' attention we would like to point out the idea of symbolic increase of the significance of a task at hand. The coach can temporarily increase the value of an upcoming shot, game, match by making it count double or triple when compared to usual conditions, e.g. by announcing: "This shot counts double", "This is a deciding (game, set or match) point (shot, throw, etc.)", "First two points of the game count double", or "First game of the set counts double".

Sometimes one can hear soccer coaches trying to raise their players' attention by describing the upcoming match as a so-called "6-point match", which is the double worth of a normal win in a soccer league match. Recently one of the soccer coaches (coaching a team struggling against relegation from the German Bundesliga) explained in a TV interview how he was trying to raise the motivation and concentration of his team with the following words "The remaining four matches of the league season are for us like four finals in a row".

Another idea to keep up athletes' attention is to gradually increase the stakes, e.g. the point value of successful task repetitions.

We would also like to point out the value of requiring many successive tasks repetitions (e.g. 100 successive shots on target), because until the end of such long lasting performances the risk of wasting the already invested time or effort raises most of the time player's attention intensity.

Principle of introducing novelties

To complete the list of principles of constructing exercises improving attentional skills it is necessary to remember about introducing novelties and making progressions. Considering the fact that new stimuli do increase attention it should inspire the coaches to introduce novelties into their training regime. In tennis, it could mean exercising in new venues, on new surfaces, using new utensils (rackets, balls), playing with new partners, opponents, introducing new tasks or slightly changing already known exercises.

Principle of systematic progressions

A special way of introducing novelties is quite undoubtedly by using systematic progressions. This principle should encourage coaches to gradually increase the attentional

demands of training exercises, as described by previous principles. It can also be done by implementing simultaneously more and more principles of constructing attentional exercises. For example, it could mean combining in one exercise a measurable goal with meaningful consequences of successful or unsuccessful performance, or high precision requirements with high demands on perception (anticipation), or the need for making correct decisions with the need for switching attention quickly and frequently, and last but not least, the need to control many objects with executing many activities at the same time.

One could also think about an attentional activity constructed according to all of the above principles, which would make a "perfect exercise for improving attention". It would have to be a measurable task involving challenging actions (because of the complex movements, rhythm and action changes, extraordinary precision, speed, power or endurance requirements), and/or highly demanding information processing, in new but sport specific environment settings (including specific distracters) with meaningful consequences of the performance outcome.

In order to facilitate the use of the principles discussed above Table 14 presents a short review including an abbreviated name of each principle and basic ways of its implementation.

The principles of developing attentional skills have been defined after thorough analysis of both general sport and also tennis specific exercises, and possess a universal character. They can be used by specialists of many different sports to modify existing exercises by increasing their attentional value (power) or constructing completely new ones.

It must be also emphasized that attentional exercises should not only temporarily increase the participants' attention but also contribute to developing the awareness of one's focus and the ability to manage (change at will) its intensity, cope with fast shifts, change the scope, be able to ignore irrelevant objects, and be able to maintain concentration over many repetitions or a longer time.

Table 14. Summary of principles for constructing attentional exercises

	Name of principle	How to implement this principle?
1.	Measurable goals	Define challenging actions and criteria for their successful execution Require a desired number of (successive) successful task repetitions Limit the number of (successive) errors allowed Set time limits.
2.	Precision demands	Demand spatial precision: determine target size, racket size, etc. Demand temporal precision: set time span Demand dynamic precision: set speed or power span
3.	Perception demands	Set a superior speed of the perceived moving object (e.g. ball) Reduce the size of the moving object Reduce the distance between the players (of the ball flight) Include ball ricochets, "bad bounces", deflections Limit the main sense function Limit the cooperating sense function
4.	Capacity demands	Set a challenging number of objects or details that need to be perceived simultaneously, and distribute them on a relatively big area (field) size Set a challenging number of different actions that need to be executed simultaneously or consecutively
5.	Shifting demands	Arrange shifting attention from object to object, action to action, etc. Implement changes of the way of execution (rhythm, speed, etc.) Implement changes of the scope of attention (narrow, broad) Set a challenging speed and/or frequency of attention shifts
6.	Decision-making	Determine a challenging number of available courses of action and define the criteria for their selection
7.	Specific environment	Use specific objects: ball, racket, court, net, opponent, score, player Use specific actions: footwork, stroke production Use specific tactical situations: serving, receiving, both in the backcourt, attacking, defending
8.	Specific distracters	Create specific visual distracters Create specific audible distracters Create specific tactile distracters Create specific kinesthetic distracters
9.	Meaningful consequences	Set potentially meaningful gains for athletes Set potentially meaningful risks for athletes
10.	Novelties	Exercise in new venues, on new surfaces, using new utensils (rackets, balls), playing with new partners, opponents, introducing new tasks or slightly changing already known exercises
11.	Progressions	Gradually increase the attentional demands Apply more and more principles in one exercise at the same time

REFERENCES

- [1] Bachmann S., Meier M., Schlagkräftige Ideen, Swiss Tennis, Basel 2005.
- [2] Baumann S., Psychologie im Sport, Meyer & Meyer Verlag, Aachen 2000.
- [3] Bręczewski G., Gronek P., Trening koncentrowania uwagi w przygotowaniu psychicznym sportowca, system AMBER (Concentration training in athlete's mental preparation). *Sport Wyczynowy*, 2009, 135-143.
- [4] Crespo M., Reid M., Quinn A., Tennis Psychology: 200 + practical drills and the latest research, ITF Ltd., London 2006.
- [5] Czajkowski Z., Psychologia sprzymierzeńcem trenera (Psychology as a coach's aid), Centralny Ośrodek Sportu, Warszawa 1996.
- [6] Deutscher Tennis Bund, Tennis-Lehrplan Bd. 2, BLV Verlagsgesellschaft, München 1996.
- [7] Kłodecka-Różalska J., Przekraczanie umysłem możliwości ciała (Mental overcoming of bodily

- capabilities), Centralny Ośrodek Sportu, Warszawa 1996.
- [8] Krawczyński M. & Nowicki D., Psychologia sportu w treningu dzieci i młodzieży (Psychology of sport in training of children and adolescents), Centralny Ośrodek Sportu, Warszawa 2004.
- [9] Lloyd M. & Terry P.C., What Champions Think: Optimal Attentional Strategies for 2000 m Rowing, (in:) 2006 Joint Conference of the Australian Psychological Society and the New Zealand Psychological Society, 26-30 Sept. 2006, Auckland, New Zealand.
- [10] Morris T. & Summers J., Psychologia sportu. Strategie i techniki (Psychology of sport: Strategies and techniques), Centralny Ośrodek Sportu, Warszawa 1998.
- [11] Quinn A., Prepare Your Mind to Win, (in:) Applied sport science for high performance tennis, Proceedings of the 13th ITF Worldwide Coaches Workshop, Vilamoura, Portugal, October 2003, pp. 100-105.
- [12] Railo W., Besser sein wenn's zählt, Pagina GmbH, Friedberg 1986.
- [13] Schefke T. & Gronek P., Improving attentional processes in sport: defining attention, attentional skills and attentional types, *Studies in Physical Culture and Tourism*, 2010, Vol. 17, No. 4, pp. 295-299.
- [14] Schefke T. & Gronek P., Improving attentional processes in sport: sport specific issues in the effective playing time, *Studies in Physical Culture and Tourism*, 2011, Vol. 18, No. 1, pp. 9-18.
- [15] Weinberg R.S. & Gould D., Foundations of sport and exercise psychology, Human Kinetics, Champaign 2003.
- [16] Winter G. & Martin C., Sport 'Psych' for Tennis, South Australian Sports Institute, Adelaide 1991.