

The Evaluation of Offensive Tactical Efficiency by a Specific Volleyball Test

by

Dorota Szade¹ Bartłomiej Szade²

The main objective of this paper is an attempt to characterize and evaluate the attacking possibilities of male and female players representing different sports levels. The research was based on the analysis of individual attacking principles in volleyball. It was conducted on 4 groups of 12 volleyball players. The first two groups included male and female division I players with a high degree of training and game experience, while the other two were composed of juniors of both sex. The research was conducted only on right handed players which specialize in attacking. The main research tool applied in this project included a specific volleyball test developed by the author. The main objective of the test was to evaluate the speed and correctness of choosing tactical principles under changing game conditions. The analysis of obtained data allows for the following conclusions. The examined groups of volleyball players represent a similar level of knowledge of individual principles of attacking, which is not dependent on training experience or sex. A strong relationship between theoretical knowledge of attacking principles evaluated by a written test and the results of the specific computer volleyball simulation test do not exist. The constructed test may be an efficient tool in teaching children and youth theoretical principles of attacking in volleyball.

Key words: volleyball, tactical principles, computer simulation

¹ - Academy of Physical Education in Katowice, Dept. of Team Games,
dorotasz@awf.katowce.pl

² - Academy of Physical Education in Katowice, Dept. of NT

Introduction

During the last quarter of a century the character of play in volleyball has changed dramatically, not only because of rule modifications but mainly through the introduction of new tactical concepts and better motor development. The increase in game intensity demands great anticipation from players, who have to perform complex skills efficiently and quickly under constantly changing conditions. The rule changes in volleyball were minor until 1998 when the World Volleyball Federation (FIVB) drastically changed the scoring in particular sets and the types of substitutions.

The main objective of the rule changes was to create the game more attractive, especially to increase the pace of the game. The standing serve, previously a passive element, changed into the spike serve and became one of the more powerful offensive tools in volleyball. The psychomotor demands are constantly increasing. Today's players require great speed of reaction, anticipation, superior concentration as well as exceptional space orientation and motor adjustment. Czajkowski (1995) indicates the significance of psychomotor evaluations and analysis in combat sports and team sports. Naglak (2001) confirms the opinion that team sports need parallel development of conditioning, technical and tactical skills as well as psychomotor preparation.

Teaching tactical skills is a process of developing certain tactical behaviors with the ability of intentional application of these skills during a game under changing conditions. These goals are reached through theoretical and practical preparation of athletes (Pieron and Ligot 1977, Wilkinson 1992, Sonnenbichler 1994). If a player is to apply certain tactical principles in a game situation he must be familiar with them and should understand them (Kowalski 1993). Theoretical training sessions thus seem very important in this process. Lectures, discussions and the use of modern technology with computer simulations are a must in modern teaching of tactics.

The highest level of play in volleyball is based on totally automatic movements, which are modified accordingly upon environmental changes. The ability to effectively apply individual tactical skills in a game situation is significantly related to perception the speed of reaction.

The main objective of this paper is an attempt to characterize and evaluate the attacking possibilities of male and female players representing different sports levels. The research was based on the analysis of individual attacking principles in volleyball (Szade et al 2004).

Material and methods

The research was conducted between March and May of 2004. They include 4 groups of 12 players each. The first two groups include male and female division I players with a high degree of experience, while the other two are composed of juniors of both sex. The research was conducted only on right handed players which specialize in attacking. Table 1 presents the basic characteristics of these participants.

Table 1

Basic characteristics of male and female volleyball players

	Men I division (n = 12)		Women I division (n = 12)		Juniors male (n = 12)		Juniors female (n = 12)	
	\bar{x}	SD	\bar{x}	SD	\bar{x}	SD	\bar{x}	SD
Age (yrs)	22,75	2,01	23,00	4,59	15,50	0,52	15,58	0,51
Eperience (yrs)	9,67	3,23	9,17	3,95	3,58	1,00	3,58	1,24
Body height (cm)	189,67	4,31	177,92	3,32	186,58	4,19	176,58	4,62
Arm reach (cm)	247,42	5,87	231,83	3,95	248,17	6,83	233,83	6,58
Jump height (cm)	328,67	18,04	285,42	6,27	312,58	10,31	282,92	7,01

The main research tool applied in this project included a specific volleyball test developed by the author (Szade, Slomka 2004). The main objective of the test is to evaluate the speed and correctness of choosing tactical solutions under changing game conditions (photo 1 and 2).



Fot. 1



Fot. 2

Sample photos included In the specific volleyball test

The computer simulation included 60 photos representing different defensive setups. Each photo also included two colored circles on the field which determined the direction of the attack. The prepared simulations were consulted with volleyball coaches and experts, what resulted in modification of 10 situations and rejection of 20. All players were subjected to the computer test during which successive options were shown on a screen and the player chose the optimal solution in as short of a time as possible. The following variables were registered:

- the number of correct and improper decisions
- time of decision selection
- the average time of correct and improper decisions
- repeatability of correct and improper decisions
- percentile index of decision repeatability

The other tool that was used was a test of knowledge of individual tactical principles of attacking in volleyball. In the first part of the test the players had to name as many principles as they knew, while in the second part they chose from 17 presented only those which applied to individual attacking. The following variables were obtained:

- the amount of properly written principles of individual attacking
- the amount of properly chosen principles of individual attacking
- the amount of incorrectly chosen principles of individual attacking

For statistical purposes the “Statistica” program (Software 1995) was used as mean values (\bar{x}) and standard deviations (SD) were calculated. All data was tested for homogeneity of variance using the Levene’s test and then analyzed using the analysis of variance (ANOVA) to determine the differences between the 4 tested groups. Significant main effects and interactions were further analyzed using the Tukey post hoc test (Stanisz 1998). The relationships between particular results were determined using the Pearson’s linear correlation coefficients (Dziembala 1975). The level of significance for all analyses was accepted at $p < 0.05$.

Results

The knowledge of principles of individual attacking was evaluated through a written test. Three variables were excluded after this test:

- the number of individually chosen principles
- the number of correctly chosen principles
- the amount of improperly chosen principles

In order to determine the differences between particular groups in relation to the knowledge of chosen principles of attacking in volleyball a 2-way ANOVA was used. The two independent factors included sex (male or female) and age (senior or junior). The results of ANOVA show no significant inner group differences for both considered factors. It is worth noticing that females had a slight advantage over males in all aspects of the test. There was a significant interaction of factors in the variable improperly chosen principles (tab.2).

Table 2

The results of ANOVA for the knowledge of individual tactical principles (n=12)

Variable	Factor	F	p
Wymienione	1-age	1,405	0,242
	2-sex	0,258	0,614
	1 x 2	1,835	0,182
Chosen properly	1-age	0,022	0,883
	2-sex	2,667	0,110
	1 x 2	0,198	0,658
Chojen improperly	1-age	0,328	0,570
	2-sex	0,642	0,427
	1 x 2	8,194	0,006

The results of ANOVA also indicate that statistically significant differences occur in training experience between both age groups. There were no significant differences in relation to sex in the tested groups (tab.3).

Table 3

The results of the ANOVA for training experience (n=12)

Variable	Factor	F	p
Training experience	1-age	57,1883	0,0001
	2-sex	0,1050	0,7474
	1 x 2	0,1050	0,7474

In order to determine the relationship between the knowledge of individual attacking principles and training experience Pearson's correlation coefficients were calculated (tab.4).

Table 4 presents the correlation coefficients between the results of the test evaluating the knowledge of individual attacking principles and training experience in particular groups of players. In junior male and female volleyball

players a significant ($r=0.58$ and $r=0.51$) relationship occurred between the amount of individually listed principles of attacking and training experience. This may confirm, proper coaching in these groups were practical sessions are accompanied by theoretical ones related to tactics.

Table 4

Corelation coefficients of training experience and the knowledge of individual tactical principle

Tactical principles	Men I division (n = 12)	Women I division (n = 12)	Juniors male (n = 12)	Juniors female (n = 12)
Wymienione	-.09	.29	.58	.51
Chosen correctly	.50	-.10	.23	.13
Chojen incorectly	-.18	.42	-.27	-.01

Bold ink indicates significant relationships $p=0,05$

Tactical effectiveness was evaluated by means of the specific volleyball test. The following variables were excluded from this test:

- amount of correct decisions
- amount of improper decisions
- average time of correct decisions
- average time of improper decisions
- maximal time of correct decisions
- maximal time of improper decisions
- minimal time of correct decisions
- minimal time of improper decisions
- repeatability of conducting correct decisions
- repeatability of conducting correct decisions
- coefficient of validity of decision making

The results of ANOVA indicate significant inter group differences for the sex factor for the following variables: average time of correct decisions, maximal time of improper decisions, minimal time of correct decisions and minimal time of improper decisions. There were no differences in relation to age categories. There were significant interactions between the age and sex factors in case of the following variables of the volleyball test: amount of correct decisions, amount of improper decisions and minimal time of improper decisions (tab.5).

The differences between variables (amount of correctly and improper decisions made in the volleyball test) are not significant between the tested

groups. Senior male players commit more improper tactical decisions than their female counterparts while the opposite is true for junior players.

Table 5

The results of ANOVA for the specific volleyball test (n=12)

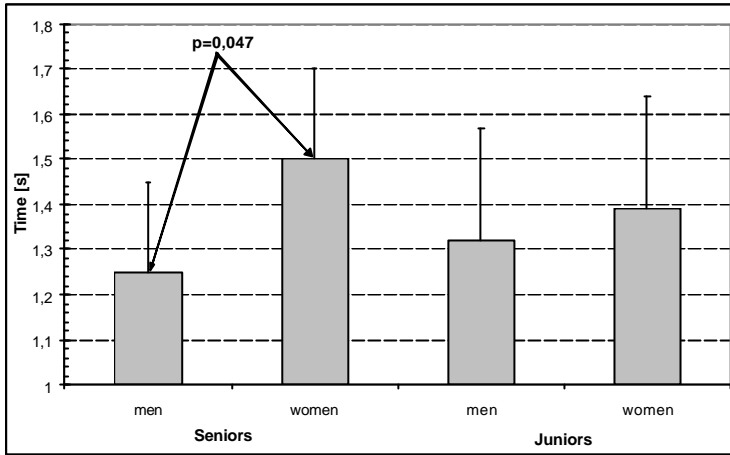
Variable	Factor	F	p
The number of correct decisions	1-age	1,2664	0,2665
	2-sex	2,5985	0,1141
	1 x 2	8,3488	0,0060
The number of incorrect decisions	1-age	1,2664	0,2665
	2-sex	2,5985	0,1141
	1 x 2	8,3488	0,0060
The average time of correct decisions	1-age	0,0309	0,8612
	2-sex	4,2230	0,0458
	1 x 2	1,4647	0,2326
Maximal time of incorrect decisions	1-age	2,5273	0,1191
	2-sex	5,1306	0,0285
	1 x 2	1,1717	0,2850
Minimal time of correct decisions	1-age	0,2277	0,6356
	2-sex	4,9332	0,0315
	1 x 2	0,7953	0,3774
Minimal time of incorrect decisions	1-age	0,8047	0,3746
	2-sex	8,5683	0,0054
	1 x 2	4,3810	0,0421

The table included only those variables in which significant relationship occurred.

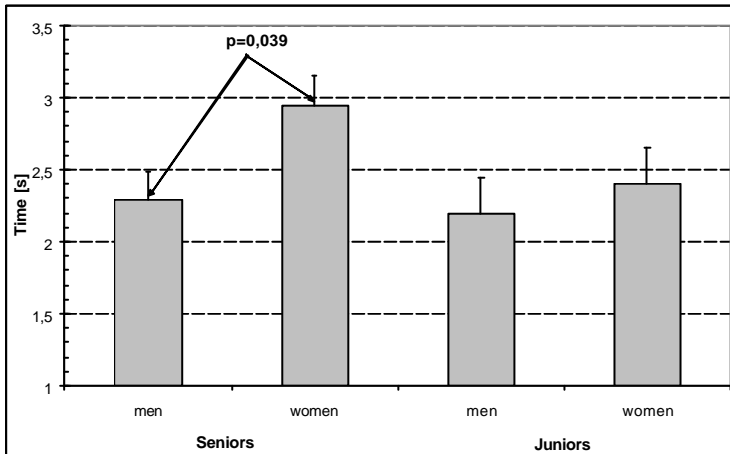
Bold ink indicates significant correlation coefficients $p=0,05$

Differences between particular groups of volleyball players were evaluated by the Tukey's post hoc tests. The senior male and female groups differ significantly in case of average time of correct decisions ($p=0.047$). In the junior category no significant differences were registered in relation to the average time of correct and improper decisions (Fig.1).

The average values of the maximal (longest) time of improper decision making shows significant sexual differences in the senior group of players ($p<0.05$). The differences between the other age categories are not significant in case of the maximal time of conducting correct and improper decisions in the specific volleyball test (Fig.2).

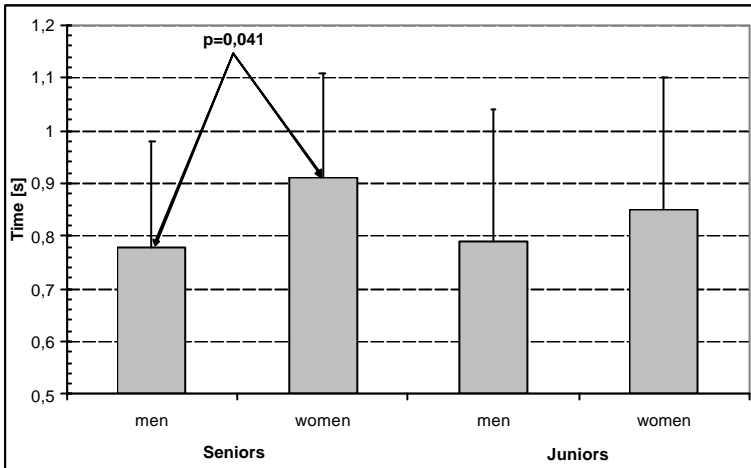
**Fig. 1.**

The differences in results of the tested groups in relation to the average time of properly chosen decisions in the volleyball test

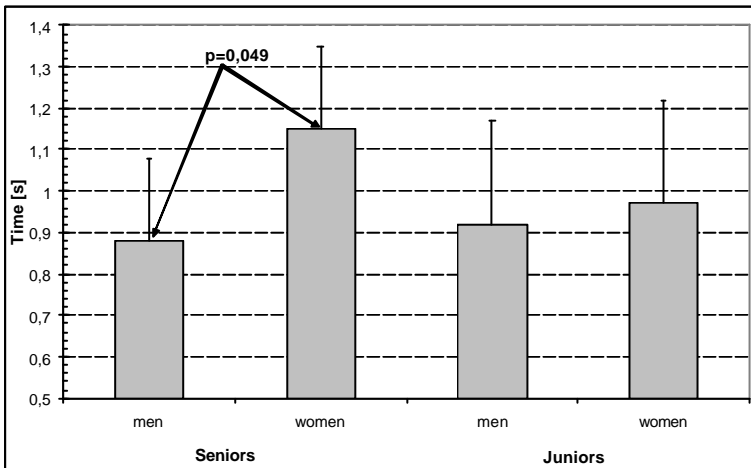
**Fig. 2.**

The differences in results of the tested groups in relation to the maximal time of properly chosen decisions in the volleyball test

The obtained results in the volleyball test of the variables, minimal time of correct and improper decision making differ significantly in senior players ($p < 0.05$). The same variables in the junior groups do not show significant differences (Fig. 3 and 4).

**Fig. 3.**

The differences in results of the tested groups in relations to minimal time of properly chosen decisions in the volleyball test

**Fig. 4.**

The differences in results of the tested groups in relations to minimal time of improperly chosen decisions in the volleyball test

Repeatability of correct decision making in the specific volleyball test is higher in female seniors yet this differences are not significant. The same is true in juniors were females reach slightly better results. The standard deviation of average values is smaller in senior females what indicates a smaller dispersion of results. Hen comparing the values of this variable with the average time of making correct and improper decisions, which was significantly longer in

females ($p < 0.05$), one can speculate that female volleyball players analyze the game situations in the test more precisely, what allows them to reach higher repeatability of correct decision making (Fig.1).

The remaining variables of the test related to repeatability of decision making (repeatability of improper decisions and coefficient of validity) do not show significant differences between groups.

In male I division volleyball players a significant relationship occurred between correctly chosen principles of attacking and the correctness of decision making in the specific test ($r = 0.61$). Close to significant relationship were registered in senior female players amount of improperly chosen tactical principles and maximal time of improper decisions ($r = 0.45$) and the minimal time of improper decisions ($r = 0.57$).

In junior female players the amount of correctly chosen tactical principles showed a significant relationship with average time of correct and improper decisions, as well as the maximal and minimal time of improper decisions ($r = 0.65$, $r = 0.63$, $r = 0.61$).

Discussion

It can be suggested that the proposed testing procedure of tactical efficiency may be used for evaluating game behavior in particular situations as well as for teaching different tactical principles. It must be stated that these evaluations were carried out in the laboratory, which are significantly different from game conditions. Mental stability and the lack of disturbing factors, normally present in a game situation most likely affected the results but the direction of influence (positive – negative) and strength (minor – severe) is hard to establish. It is a well known fact that factors such as fatigue, game situation and fan support can have a negative effect on performance while others such as warm up, emotions and stimulation can enhance motor performance as well as decision making.

The obtained results through the specialized volleyball test allow to conclude that the amount of correct and improper decisions made does not differentiate the tested groups significantly. The test variables average time of correct decisions, maximal time of improper decisions, as well as the minimal time of correct and improper decisions showed significant differences only in case of the senior groups. Additional variables excluded from the specific test are repeatability of correct and improper decision making and validity coefficient, calculated as the percentile of properly performed tasks.

The lack of significant relationships between variables of the specific volleyball test and the knowledge of tactical principles is difficult to explain. The theoretical knowledge and laboratory conditions of evaluating tactical

efficiency are significantly different from game situations. At a higher sports level players react instinctively to particular situations, very often being in a subconscious state. At the same time the form of expressing ones tactical knowledge and often the lack of knowledge of tactical principles may cause a significant difference between the outcome of the specialized computer volleyball test and the written evaluation of tactical knowledge.

It is well accepted, that concentration positively effects motor performance allowing to eliminate possible distractions (Singer et al 1991). Orlick (1990) indicates that the one definite factor that differentiates very effective players from less effective ones is the ability to adapt and continuously focus on the new tasks, while eliminating all distractions. The conditions under which these evaluations were made bring about different forms of distractions than under normal game situations. Eysenck and Keane (1995) as well as Moran (1996) underline that the attention of most scientists is directed at identifying external disturbances, totally omitting internal ones generated through thoughts and emotions, such thoughts and emotions may distract the player from concentrating on the specific motor performance. The lack of the above mentioned relationships between test variables and tactical knowledge may be caused by cognitive interferences (Sarason 1984), which are losses of concentration present in players during a task which are not directly linked to it. The laboratory test conditions mineralized the external disturbances thus most interruptions in concentration were caused by internal distractions. During a game situation a player is subjected to significant external interferences, which often complicate decision making yet highly experienced athletes, are subjected to stressful situations often and cope very well with such states. CNS activity evaluations in athletes especially in relation to concentration and decision making (Pesce Anzeneder et al 1997, Ripoll 1988) showed that highly qualified volleyball players develop specific tactical and strategic concepts connected with adequate stimulation of the CNS. In sports with closed loop habits athletes concentrate mainly on the goal while in open loop habit sports such as volleyball they concentrate on the probability of upcoming game situations (anticipation), thus multiple game experience cause significant changes in tactical thinking and behavior (Starks and Allard 1983, Fontani et al 1999).

Since humans can process only a limited amount of information being in sight, it is of great importance for ball players to concentrate their attention on a limited field, significant to the outcome of a particular game situation. The main mental objective in volleyball seems to be related to limiting concentration to significant areas and to eliminate those irrelevant to performance (Lum et al

2002). Scientists explain the superiority of athletes by better distribution of concentration, which means many objects of attention (Nougier et al 1992), better transition from one object to another (Castiello and Umita 1992), or they better adopt different strategies (Enns and Rensink 1992). It seems worth noticing that players with greater training and game experience exhibit better abilities in the area of visual concentration (Anzender and Boesel 1998). Also of interest may be the fact that athletes representing sport disciplines of high visual dynamics (archery, volleyball) have better orientation than those from sports with low visual dynamics such as swimming (Nougier et al 1996).

The search for factor determining individual tactical decision making in volleyball is very difficult. The tactical operations of a player, constant decision making with the consideration of defensive set ups, the positioning of partners and the speed and direction with which the ball travels, tactical principles and the game situation are strictly related to the experience gathered in the process of motor learning (Szapiro, Superlak 2003). The presented test may be a valuable tool for coaches and scientist in evaluating tactical efficiency and in the teaching process of tactical principles. The following conclusions may be drawn from this research project.

Conclusions

The obtained empirical data and the analysis of current literature allow to formulate the following conclusions.

1. The examined groups of volleyball players represent a similar level of knowledge of individual principles of attacking, which is not dependent on training experience or sex.
2. A strong relationship between theoretical knowledge of attacking principles evaluated by a written test and the results of the specific computer volleyball simulation test do not exist.
3. The constructed test may be an efficient tool in teaching children and youth theoretical principles of attacking in volleyball.

References

- Castiello U., Umita C. (1992) Orienting of attention in volleyball players. *International Journal of Sport Psychology*. 23, s. 301-310.
- Czajkowski Z. (1995a) Istota i znaczenie nawyków czuciowo-ruchowych w dzialalnosci sportowej oraz ich wzajemnosci ze sprawnoscia czynnosciowo-ruchowa. Katowice: AWF.
- Czajkowski Z. (1995b) Jak byc szybszym? *Sport Wyczynowy* nr 1-2; s. 134-138.

- Dziembala L. (1975) Podstawy statystyki. AE, Katowice.
- Enns J., Rensink J. (1992) Visual attentional orienting in developing hockey players. *Journal of Experimental Child Psychology*, 64. s. 255-275.
- Eysenck M., Keane M. (1995) *Cognitive Psychology: A Students Handbook*. Hove: Lawrence Erlbaum Associates.
- Fontani G., Maffei D., Cameli S., Polidori F. (1999) Reactivity and event-related potentials during attentional tests in athletes. *European Journal of Applied Physiology*. 80, s.308-317.
- Lum J., Enns J., Pratt J. (2002) Visual orienting in college athletes: explorations of athlete type and gender. *Research Quarterly Exercise in Sport*. Jun;73(2), s. 156-167.
- Moran A. (1996) *The psychology of concentration in sport performers: A cognitive analysis*. Hove: Psychology Press.
- Naglak Z. (2001) *Teoria zespolowej gry sportowej*. Kształcenie gracza. AWF Wrocław.
- Nougier V., Azemar G., Stein J. (1992) Covert orienting to central visual cues and sport practice relations in the development of visual attention. *Journal of Experimental Child Psychology*, 54. s. 315-333.
- Nougier V., Rossi B., Alain C., Taddei F. (1996) Evidence of strategic effects in modulation of orienting of attention. *Ergonomics*, 9. s. 1119-1133.
- Orlick T. (1990) *In pursuit of excellence*. Champaign, IL. Leisure Press. Panfil R. (1991) *Dyspozycje umysłowe a sprawność działania w podczas gry w piłkę nożną*. *Sport Wyczynowy* nr 1-2,
- Pesce Anzeneder C., Bose R., Kortmann O., Mucke M. (1997) *Attività cerebrale e prestazione attentiva nel pallavolista*. *SDS-Rivista di cultura sportiva*. 16, s. 53-62.
- Pieron M., Ligot M. (1977) *Analyses des structures tactiques elementaires en volleyball*. Sport 1.
- Ripoll H. (1988) Analysis of visual scanning patterns of volleyball players in a problem solving tasks. *International Journal of Sport Physiology* 19, s. 9-25.
- Sarason I. (1984) Stress, anxiety and cognitive interference: reaction to tests. *Journal of Personality and Social Psychology*. 46, s. 929-938.
- Sonnenbichler R. (1994) Individual tactics - learning to read movements. *International volleytech (Lausanne)*; Apr (1). s. 17-20.
- Stanisz A. (1998) *Przystępny kurs statystyki*. Kraków.
- Starkes J., Allard F. (1983) Perception in volleyball: the effects of competitive stress. *Journal of Sports Psychology*, 5. s. 189-196.
- Superlak E. (2003a) *Analiza stałości decyzji gracza w aspekcie zmiennych dyspozycyjnych i sytuacyjnych (na przykładzie gry w piłkę siatkową)* (In:) Chmura J, Superlak E (red.), *Dyspozycje osobnicze do gier sportowych*. WNT Wrocław, s.39-50.

Szade D., Slomka K., Kapica T. (2004) Wykorzystanie zasad taktyki indywidualnej ataku w piłce siatkowej. Zeszyty Metodyczno Naukowe AWF Katowice.

Szapiro T. (1993) Co decyduje o decyzji? PWN Warszawa

Wilkinson S. (1992) Effects of training in visual discrimination after one year: visual analysis of volleyball skills. *Perceptual and Motor Skills*. Aug;75(1), s. 19-24.