Level Determination of Space Orientation Depending on Manual Laterality and Using Artificial Intelligence Techniques

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Abstract: - There have been relatively poor attempts to implement artificial intelligence techniques in sports that can determine and influence the motric performance. It is a fact that developing and implementing intelligent and informational technology represents a new approach in what the improvement of sportive outcomes are concerned, which leads to a dynamic result of a controlled and optimized training process.
The level determination of sportsmen's space orientation depending on the motric prevalence forms an important aspect in sport practice and an essential element in selecting the various sportive disciplines.
We consider that software usage will increase the improvement of precision in order to determine the level of space orientation according to the manual laterality of sportsmen.
When the technical expression possibilities have no limits and the competitional requirements are increasingly higher, we consider that the education of space orientation may constitute an important element in increasing the efficiency of game actions, in creating an advantage in sports disputes and this is the reason for which we do not agree with the opinions expressed by some researchers who consider that ambidextry should be combated.
The modern, advanced game is carried out in full speed, constant rhythm, which supposes some considerable physical effort. Besides the execution speed, the force, the coordination, the general mobility and the gracefulness necessary for executing the most complex and varied movements, it is also necessary to cultivate the space orientation, the "sense" of the ball, the rhythm, the equilibrium and implicitly the movement by learning as many technical-tactical actions as possible, which involve safety in catching the ball, accuracy in passing and finishing actions, etc.

Key words: - Space Orientation, Manual Laterality, Motric Prevalence, Sportsmen.

1 Introduction

The research and analysis of factors and components determined by sportive performance require an ample usage of artificial intelligence means, due to a high number of variables influencing in a determined way the gesticulatory set of sportsmen [5].

Space awareness with accent on surfaces, levels, directions, extensions and trajectories materializes on using space and developing place awareness, where body is found during movement.

As the variation and control of using space facility develops, the sportsman extends the possibility to make an efficient and effective move. In this manner, although the objective is set on the space, the sportsman has to figure out where his body and its segments are found in that space [7].

Software usage will produce improvement of precision in order to determine the level of space orientation depending on the manual laterality of sportsmen practicing handball, where space orientation and technical craft are essential.

Computerized determination of space orientation capacity will allow professionals to optimize the training and manifestation process during sports events within heuristic sportive disciplines, where the level of those elements of psychomotric capacity is essential.

2 Theoretical background

Psychomotricity allows the knowing of human being from the perspective of interrelationship between psychic and motric plan and has a significant role for the psycho-behavioral system of sportsmen.

The area of psychomotricity is broad and has a very complex and varied content. According to the motric behavior plan, psychomotric elements play an important

role in the volunteer adjustment of actions, not only referred to intention, space orientation, but also to follow up mechanisms, control and coordination-compensation [4].

The main components of psychomotricity are:

- Body diagram
- Laterality
- Space-time organization
- General and sequential coordination
- Static and dynamic balance
- Ideomotricity
- Motrical intelligence
- Motion speed

Every sensorial surface (skin, retina, etc) is directly connected to a specific sensory field, which is found in the opposite cerebral hemisphere corresponding to the sensory surface.

In each cerebral hemisphere is found a motor centre. There are identical connections between the two cerebral hemispheres, and the majority of neurons have a correspondent in the opposite direction.

2.1 Space structure

Space awareness is a critical aspect. The ability to negotiate space has to be fully developed if an efficient functioning within a space often limited in shape, size, and appliance arrangements is expected as well as if the movement combination with others is expected.

Space notions such as "high-low, left-right, inside-outside, ahead-behind" already used in many of the exercises specific to sportive training can be integrated into sportsmen's perspective if we take into consideration the space-time, thought-action and himself-others relation and also concepts such as: space arrangement, distance, anticipation, transposition., etc.
Research regarding the interrelationship between laterality and space orientation capacity has been conducted by L. Stell, B. Caldwell, D. Dake, M. Saffly and L. Ulch [6].

As a result of evolution, human being has acquired a feature that cannot be encountered on any other life form on Earth, namely, the specializing of human hemispheres for certain specific activities, and this is called "laterality".

Francine Lauzon considers laterality as "the interiorized knowledge of the two parts of the body" [4]. This translates by the perfection utilization of one of the body parts in executing motric tasks, using the ability to differentiate the left part from the right part. Laterality manifests in the arm's left or right predominance, the eye's or legs in executing praxis.

We can consider laterality as internal awareness of the two body parts as well as awareness of the fact that they are different. If this distinction concept is not acquired, it becomes very difficult to learn to coordinate yourself.

All research prove that lateral dominance manifests through a relative functional prevalence (we cannot talk about 100% left handed or right handed people) and its intensity is influenced by multiple causes.

The dominance of one of the cerebral hemispheres is expressed through motric prevalence on the opposite part of the body, therefore the right handed has a dominant left hemisphere and the left handed has a dominant right hemisphere.

The competencies of each cerebral hemisphere are different, specializing as a consequence of human evolution process. Both hemispheres participate simultaneously to carry out every function, but the influence of their contribution is different according to the nature of the stimulant or task.

The operational capacities of the cerebral hemispheres depend on the implied mechanisms to carry out a given function and not on the type of information that has to be treated.

The elements that determine the contribution of each hemisphere to complete a function are: the nature of the task, the context situation and the embraced resolving strategies [1].

2.2 Laterality manifestation

Crossed laterality – the ability to use opposite parts, inferior or superior of the body, synchronizing with each other (for example: moving the right arm and the left leg). Crossed laterality arm-dominant eye is considered to affect performance in some sports such as target firing.

Crossed laterality can be encountered in children before establishing the dominant arm particularities. It is known that if a child has learning problems he is either left handed or with crossed or opposite laterality and this is why the causes of these problems have to be carefully identified.

Laterality – the ability to use segments and pairs of organs from only one part of the body; (for example: the left hand and leg, the left hand and eye).

Bilateralism - the ability to use the inferior or superior half of the body independently (the arms execute a certain move, the legs a totally different one).
Various specialists mistake the term of bilateralism with the sportsmen availability to perform on both sides of the field.

Many scientists dealt with the delimitation issue of cerebral hemispheres specialization, which led to numerous classifications. To complete a task, the cerebral hemispheres contribute differently due to the following factors: the nature of the task, the

circumstances and the resolving strategies [1]. The cerebral hemispheres' abilities are presented [3] in the Table 1.

Table 1

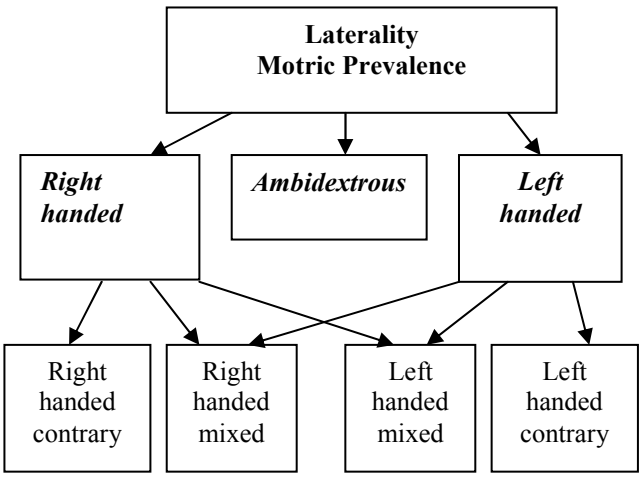
Left hemispehere dominance	General function	Right hemipshere dominance
- words - letters	visual	- geometrical model - faces - emotional expressions
Lingvistic sounds	auditive	- non lingvistic sounds - music
Movement groups	Tactil	- tactil sense - braille writing
Movement groups	motion	Space movement
Verbal memory	memory	Non verbal memory
- speech - reading - writing	language	Emotional satisfaction
Arithmetics	Space ability	- Geometry - direction - distance

2.3 Types of laterality

According to a given segment the following types of laterality are encountered: Manual; Podal; Ocular; Acoustic; Combinations of them.

According to the motric prevalence characteristics the subjects are divided in: Left handed; Right handed; Ambidextrous.

We consider that depending on the motric prevalence, the subjects division can be represented in the following scheme:



The main characteristics and differentiations of the types of laterality are:

- complete left handed – the subjects that use predominantly the left arm, leg, eye and ear on the basis of a right cerebral dominance;
- complete right handed – the subject that uses predominantly the right arm, leg, eye and ear on the basis of a left cerebral dominance;
- for many subjects the laterality is crossed and every one differentiates by his own laterality formula (left handed or right handed according to the analyzed level);
- ambidextrous – the person that uses with the same ability both symmetrical segments;
- mixed left and right handed – those persons that carry out some actions with one part of the body and other actions with the opposite part (for example: children that hit with the left arm and throw with the right arm);
- false left or right handed – (contrary left handed or right handed) – the person using the left or right segment (left/right arm and leg) as an effect of their training, forced by certain accidents of the right segments.

The symmetric learning of motric skills specific to handball, but also the other sports branches, determines a harmonious bilateral development of the body, mitigating the negative effects which emerge as a consequence of the practiced sport.

We consider that the symmetrization process of the technical-tactical actions must be in the future a permanent concern of specialists, because the game's technique is permanently renewing, and the education of players' ambidextry may constitute an advantage in efficientzing the game [1].

The specialists in this field try to create new models superior to the actual ones, which are modified according to the new evolutive tendencies.

We consider that the education of players' ambidextry, no matter the practiced sport, shall determine an enrichment of the space orientation, the game rhythm by the increase of the technical-tactical mastery, by improving the capacity to handle the ball and to evolve on both sides of the sports ground [1].

3. Problem solution

3.1 The purpose and hypothesis of the research

We have set as a main purpose the computerized testing of the sportsmen's space orientation capacity level according to the manual laterality, using special software, with the view of optimizing sportsmen selection and training processes.

To elaborate the hypotheses of the research we have started from the following assumptions:

- Space orientation capacity is determined by the

sportsmen's motric prevalence.
- Using software can determine the increase of precision of space orientation capacity level.

3.2 Means and tools of research

We started the research from the idea that by testing space orientation capacity according to sportsmen's motric prevalence with the help of software, the precision degree increases and the influence of external variables is diminished.

The research took place in August 2009 and covered a total number of 40 subjects (20 sportsmen and 20 sportswomen) handball players, within the age group of 19-25 years, 20 of them having a right manual dominance (right motric manual prevalence, therefore left cerebral hemisphere dominance) and the other 20 having a left manual dominance (right cerebral hemisphere dominance)

The subjects were put trough the **Labyrinth Test** for which a software was created requiring the following materials: a computer, a joystick, a microphone connected to the computer, a software with the help of which two labyrinths were drawn - one for the left hand, another one for the right hand.

The duration of each test was of 2 minutes, with a number of 100 labyrinth fragments.

Sportsmen received instructions regarding the testing method, the joystick manipulation method and the fact that they had to pronounce out load the direction in which it had to be headed (identifying the movement direction was important because of the way sportsmen orientated; if they hadn't identified the right direction it would have been a simple exercise of line following).

All subjects were allowed to practice before starting the test: the first labyrinth consisted of guiding the slide with the right hand, and for the second labyrinth with the left hand.

The skilled software kept not only the time of the testing but also the correct and wrong answers, by recognizing the accuracy of verbal responses.

From the various arithmetical and statistic coefficients we consider useful to analyze the testing results:
- The arithmetic average – X;
- Standard deviation – S;
-Variability coefficient – CV.

3.3 Research organization

The research developed in August 2009 covered a number of 40 sportsmen which were divided in two groups: sportswomen and 10 sportsmen, having a predominant left arm, components of both feminine and masculine teams of handball players - Division-National League.

The right handed group: made of 10 sportswomen and 10 sportsmen, having a predominant right arm, components of both feminine and masculine teams of handball players - Division-National League.

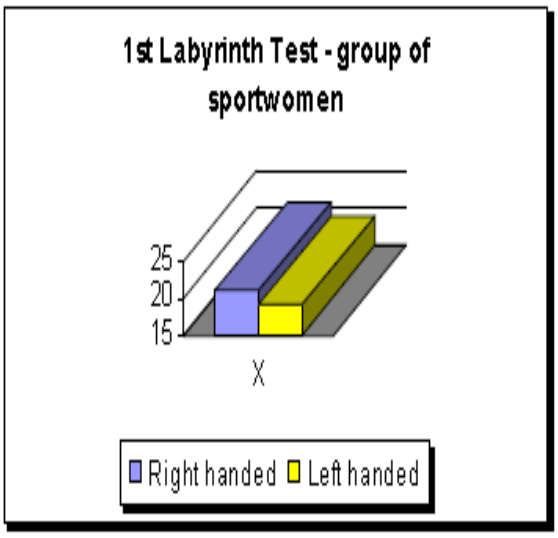
The left handed group: made of 10 - Division-National League.

3.4 Research results and graphic interpretation

Table 2 – Result summary – 1st Labyrinth Test for the right hand

Labirynth test 1							
Sportswomen group				Sportsmen group			
Statistic indeces	Right hander	Left hander	Difference	Statistic indeces	Right hander	Left hander	Difference
X-Errors	21	19	3	X Errors	23	20	2
S	1,59	1,21	-	S	1,56	0,98	-
CV	7,57%	5,78%	-	CV	6,78%	4.90%	-

Fig.1, 2 Graphic representation of arithmetical average for the first Labyrinth Test



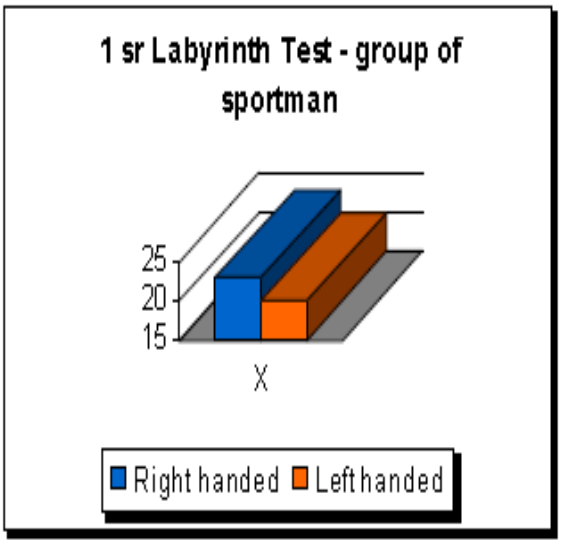
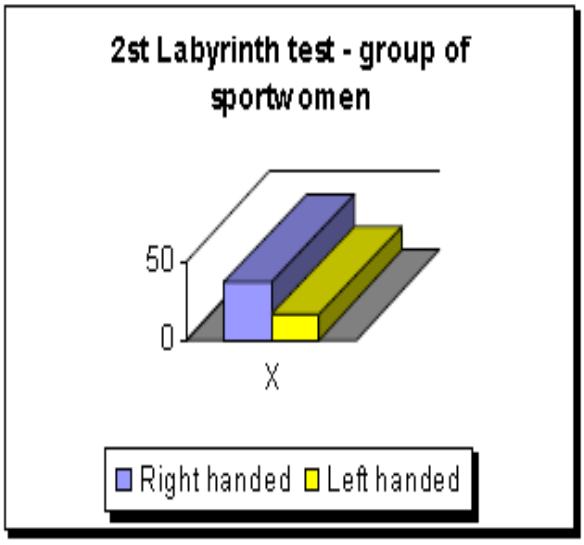
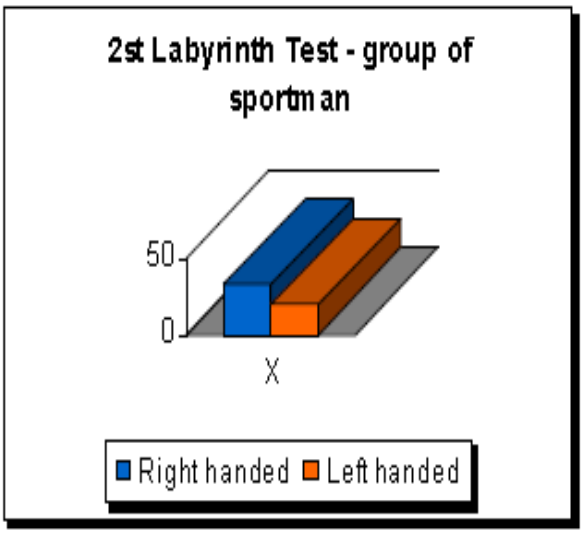


Table 3 – Result summary – 2nd Labyrinth Test for the left hand

Labyrinth test 2							
Sportswomen group				Sportsmen group			
Statistic indeces	Right hander	Right hander	Difference	Statistic indeces	Right hander	Right hander	Difference
X- Errors	38	16	22	X- Errors	32	20	12
S	3,34	1,08	-	S	2,98	1,23	-
CV	8,78%	6,75%	-	CV	9,31%	6,16%	-

Fig. 3, 4 Test and Graphic representation of arithmetical average for the second Labyrinth Test





4 Conclusions

Results confirmed the premises of this research and reflected the fact that using computerized means to determine space orientation capacity according to the motric prevalence of sportsmen can lead to the increase of evaluation precision.

The left hander's results, equally for men and women, were obviously superior to the ones of the right hander's, but it was fascinating to discover that the variance was larger in the case of left handers. It is known that abilities development for just one arm is determined by genetic and hormonal regulators.

The conclusion of this experiment was that not all left hand persons are alike, some of them are right handed but they suffer a kind of progenital anomaly and one of their cerebral hemispheres replaces the other one in order to coordinate the dominant hand. Therefore, the left hander's group has more "authentic right handers" and the right hander's group has "authentic left handers."

With regard to researching the difference of cerebral processing, referred to space abilities among men and women, the results of our research contribute to the confirmation of previous research which suggests that there are several laterality differences, not only structural but also functional.

Consequently, according to these, women have better space orientation as compared to men, as well as better perception and space visualization.

The technique is the component that designates and particularizes the structure of each sports game. The systematic training process for increase space orientation the game actions determines the increase of the players' efficiency and implicitly the teams' in the official and friendly collations.

As a result of this research we can recommend the following:

- Extending the usage of technology specific to artificial intelligence in sports in order to improve the sportive

performance.

- Using special software to optimize sportive performance which can determine the rationalization of the training process and the increase selection process efficiency in sports.

Sports games are characterized by the variety and complexity of technical-tactical situations, and also by the actions of partners and opponents, which require to the players a continuous adaptation and efficiency of the entire motric compartment. The modality of carrying out the general training and the specific training for the competitional activity claims to the players a high level of the coordinative and space orientation capacity, which allows an efficient adaptation of the technical-tactical possibilities to the concrete conditions for carrying out the games.

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