ABSTRACT OF THE DOCTORAL THESIS

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THESIS TITLE: PERFORMANCE IMPROVEMENT IN KARATE-DO THRU EDUCATION OF BEGINNERS BILATERALITY

The laterality tematics, regarding its successive passing in ontogenesis, through different stages (unconfirmed laterality, lateralisation and the laterality confirmation around the age of three, as a sign of a saturated brain development and also an efficient communication between cerebral hemispheres [which begins with the development of passing-by the midline and to interact with objects by use of the opposing members]) remains of a large interest through medical staff and psychologists.

Regarding the interest on a sporting line of this phenomena, it is explained with great effectiveness by bilateral executions with the same efficiency as motric both act and actions. Furthermore, after the laterality communication was a mandatory step in a normal brain development, most coaches are trying to reduce the laterality differences both superior train (as in e.g. Karate, Judo, Boxing, Handball, Basketball, Volley, Swimming and so on) and inferior train level also (Karate, Kick-boxing, Judo, Football, Swimming, Athletics and so on), in order to increase the victory points, to improve the attack or blocking. Because Karate-Do remains in heuristic sports cathegory and in semi-contact organised kumite, the main goal remains who gets first the winning point, it is imperative to capture the opponent's attention and the billaterality remains a way to what exactly we are wishing for. In our opinion, by approaching the laterality, which has a major role in learning, consolidation and the Shotokan-Karate techniques and stance improvement, we are being able to open new ways to research both martial arts coaches and the other sports listing.

From my point of view, as a practitioner and coach, I realised that the laterality could become an important role both initiation and performance. Meaning laterality, as a part of coordinative capacities which are responsible with learning, solidification and perfection in Shotokan- Karate, could be oriented to bilaterality. Regarding laterality chapter, in our country, there have not been made studies in Shotokan- Karate. By adding our presentation, we are coming to aid in martial arts research, by studying the laterality and its education, as a growing factor to both momentum and performance capabilities.

PART I

THEORETIC FUNDAMENTATION REGARDING COORDINATIVE MOMENTUM EDUCATION CAPABILITY– BILATERALITY IN KARATE DO BEGINNERS

Laterality as a part of coordinative capacities, has had an important role in numerous theses, which represent our milestone.

The main objective of theoretic research is to improve the knowledge regarding momentum, momentum capacity, coordinative capacity laterality, nervous system, cerebral hemispheres, neurons, human psychic system, learning, training, combat, performance, hardware, measure and laterality education.

Improving both Karate-do theoretic and methodical knowledge remains our primary goal research. We mentioned the testing and researching of the laterality even from the childhood, in technical and tactics of the karate-ka. Another milestone remains the explanation regarding equipments which are contributing to our work. The theoretical basis is trying to show us the function of cerebral hemispheres (laterality) and information being transported between central nervous system to effectors. Next, we are presenting the preliminary tasks:

- Studies of specific literature
- Meetings with scientific coordinator, INCS research staff and other specialists.
- Documentation regarding hardware and specific methods in our work
- Laterality Test Identification in order to determine the laterality, being presented on specific literature.
- Recording, transformation and information thru studies, remarks and specific talks with the domain specialists.

PART II

CHECKINGS REGARDING BILATERALITY MEASURING AND EVALUATION BY USE OF LAB EQUIPMENT

We are presuming that the preliminary research is conducted by using the high-end equipment, which will led our knowledge through precision and multiple data readings.

Regarding some of coordination and laterality research being conducted with this kind of equipment, we can clearly say that we have been increased our knowledge which led us to some of conclusions:

- 1. Laterality can be highlighted by use of several equipments and hardware;
- 2. Using the MOVEN equipment, we could highlight the differences between right arm and left arm karate-do execution techniques;
- 3. Regarding a simple fist hit analysis (e.g. gyaku tsuki), we could have information both superior and inferior train;
- 4. By analysing the differences between cinematic parameters of the techniques, based on right arm and left arm, we can have both quantity and quality information.

The preliminary research objectives were as follows:

- Improving of the theoretical and practical knowledge, to a better experimental research;
- Highlight of several laterality testing possibilities;
- Acquiring data, by using equipments which we intend to use in our preliminary and fundamental research.

In order to get to those upper-mentioned results, we have had to fulfill the mentioned tasks:

- Research studies, regarding the laterality highlight with the help of several equipments and hardware.
- Highlight of a specific training methodolgy in order to educate the undominant body parts with the help of certain specific and unspecific tasks.
- Establish the acquisition techniques regarding the executed task.
- Establish the analised part regarding laterality difference identification.
- By choosing the subject of preliminary research.
- Test sequence with the aid of MOVEN equipment.
- MOVEN equipment data processing.
- Establish the cinematic parameters which have been monitored.
- Cinematics parameters calculation by beginning from the position of the equipment.
- Doing the math of the chosen medium parameters, both for right arm and left arm execution techniques.
- The comparison of left/ right cinematic medium parameters in order to highlight the differences.
- Conclusion regarding preliminary research.

The preliminary research organization has been made in several stages. Since 2014, we have conducted several studies regarding laterality evidence and behavior by using different techniques. This was the year when we have had conducted a study in which we have had tried to highlight the both structural and functional muscular asymmetry.

We have used the tensiomiography to record the muscular response to a bipolar stimulus, which could led us to a contraction time, relaxing time, delay time and amplitude of contraction. Mr. Georgescu, Miron referred as <<The Subject>>and it was calculated upon 15 retries, when it was possible to measure his surface electromiographies.

In 2015, we have conducted a study in which we had to show up the complementary training effect in training the subdominant body parts, by use of the condition simulator. Both initial and final testing, were consisted in the execution of 40 direct strikes of choku tsuki as the main technique from shizen tai stance; the hits have been executed in series of 20 hits per series by using each arm, and in the test we have had a percent of 80 for simulated brake and a force of 4 daN. The Subject task was to follow a certain preset pattern of each execution and this is where the Subject received a real- time visual feedback.

Simultaneously, certain muscular group activity has been recorded by use of the wireless electromiography DelsysTringoTM equipment. Complementary training has been designed to improve the neuromuscular control and to increase the subdominant efficiency and the experiment took 7 Days. The training program has been personalised upon subject proper antropometrics.

Furthermore, in 2015, we have conducted a study where we have highlighted the laterality at the advanced karate-ka with the aid of MOVEN equipment. Three Shotokan karate-kas have been told to execute the Heian Nidan kata, and then, by following the avatar which was given by the proper equipment's software, we could choose the time intervals where we had been analysed and compared the hand- forehand intersegmental angles, hand- vertical and thigh-leg in order to make a difference between identical execution stances. (times 1, 2, 3 to the left and 4, 5 and 6 to the right). Furthermore, to prove the hypothesis (in which we said that the laterality could be highlighted by measuring of cinematics of parameter analisys, where automated movements) by use of the MOVEN equipment, the first six steps from the Heian Nidan kata and we were able to compare the both arms and legs in times 1 and 4, exactly when those stances were fixed. (Note: in theory, the 4 and 6 stances must be the mirror reflection of 1 and 3 stances). As concluded, by using the MOVEN equipment we could obtain as high levels of precision to even show the performance karateka, thus the inequality is much lowered upon long- term specific training. Furthermore, after the concluded results, where we could involve both performance and high- performance karate-kas, we could mention that there is a small reminiscence of more or less dominance, both in mobilisation tasks and also in fixed motion tasks.

Due to the lack of mention the unequaled functionality of cerebral hemispheres, we have tried to use an indirect method referred as a simple direct punch, in which we could measure the activity of the remaining body parts. Herein we have measured another test by use of the MOVEN equipment and we have had obtain data on a beginner Shotokan Karate-ka who had been told to execute two series of 10 gyaku tsuki techniques, one series with the right arm following a series with the left-one. The strikes have been taken with no material target as executed in kihon. For each execution, we have calculated the threedimensional position of the fist, the speed of the strike, the extension angle between the elbow from the hitting arm and the flexing angle of the forwarded knee, afterwards their time variance. The laterality highlight has been made through gyaku- tsuki execution techniques with the right arm and the left arm, regarding the medium values of the analysed cinematic parameters. Through this study, we can conclude to highlight the laterality both superior train and inferior train with the aid of a karate punching biomechanised method.

In 2017, we have tried to highlight the influence by practicing a sport for the kids from the IIIrd and the IVth Grades and by that, we could be able to remark and show-up two main images. First of all, we wanted to demonstrate the fact that the right hand time reaction is different than the left hand time reaction (this is mainly due to the cerebral hemispheres functional differences), and second of all, the speed of reaction/ repetition of a simple movement is different too, but in that case, the differences are slightly lower in the case of the kids who are practicing sports.

Furthermore to those studies, we have concluded the showing- up methodology regarding laterality differences with the aid of the MOVEN equipment, through the analysis of cinematic parameters by use of the gyaku tsuki technique. In that case, we have chosen for the case of monitoring, the speed punch, the elbow extension angle in time, the elbow trajectory (according to the punch trajectory), length of foot movement, forwarded feet knee flexing angle and the height variation of the coxal bone during technique.

The hypothesis of preliminary research has been checked. Nonetheless, we can conclude:

- 1. In the main research, we will use the MOVEN equipment
- 2. The analised technique will be the gyaku tsuki with tsuri ashi movements
- 3. The analised cinematic parameters will be
 - Maximum punch speed
 - Elbow extension angle
 - Coxal bone speed
 - Flexing angle of the forwarded knee
 - Difference between the hips line and the shoulders line, at the moment when the elbow extension is recording the maximum value
 - 4. The information concluded from this preliminary research led us into the establishment of the attenuation between left- right differences, by interventions both coordination and force, at superior and inferior train levels.

PART III

CONTRIBUTIONS REGARDING KARATE-DO PERFORMANCE IMPROVEMENT, THROUGH BEGINNERS BILATERALITY EDUCATION

The goal of this research was to prove that applying an original education bilaterality training program, the differences between beginners karate-ka are reduced. We proposed to ourselves that mainly in kumite, the use of attacks, blockings and shirk, both left and right, will double the winning chances. The main reasons were:

- 1. The bilateral education process at the karate-do beginners' level could be improved by use of adapted techniques for the subdominant body part.
- 2. The adapted bilateral education program for training and session training, could improve the motion and sporting performance.
- 3. The differences between the right arm and the left arm regarding the Gyaku tsuki stance from zenkutsu dachi with tsuri ashi movement will be smaller after a bilateral education.
- 4. Increasing the kumite performance will diminish by technical-tactical orientation upon opponent surprise also by use of both orientations.

The objectives of the research were as follows:

- 1. Establishing a training program in order to reduce the functional differences between the dominant and undominant parts;
- 2. Laterality cantitative and qualitative evaluation regarding conclusive idea;
- 3. Competitional performance monitoring upon the research subjects before and after the implementation of the bilaterality education program.
 - The main fulfilled tasks for the targeted objectives, were as follows:
 - 1. C.S.O. Voluntari cooperation and SKDUN component of Romanian Martial Arts Federation (FRAM).
 - 2. Separation of the lot control from the experimental lot
 - 3. Initial testing for experimental lot and the testing for control lot, with the aid of MOVEN equipment
 - a. Establish of the monitored cinematics parameters
 - b. Parameters calculation beginning from acquisition positions
 - c. Medium calculations regarding the chosen values, both right arm executions and left arm executions.
 - d. Comparison of the medium cinematics parameters, both for left/ right for each subject, in order to highlight the diferences
 - 4. The execution of the training program, regarding the experimental lot
 - 5. Final test for both of lots practicians.
 - a. Calculation of the monitored cinematic parameters, being monitored from t- zero beginning, from the position acquisitions
 - b. Calculation of medium chosen values, both right arm executions and left arm executions
 - c. Comparison of medium cinematics parameters both for left right for each of the subjects, in order to highlight the differences and the decreasing of those compared to t-zero testing on the hand and to the group control, on the other.
 - 6. Taking up the conclusions referring to specific training and laterality highlight according cinematic parameters of the studied execution technique.
 - 7. Monitor the sporting subjects performance before and after the bilateral education program implementation.

Place, interval, research subjects

The main research locations include the two Dojos (both Aiko and CSO Voluntari). Both initial and final testing have been conducted at Bucharest Sports National Research Institute.

The tested subjects were separated in two groups, the experimental was consisting of karateka who belong to Aiko Bucharest Sports Club, and the control group was consisting of karateka who belong to Voluntari Sports Club.

The monitored technical process was the gyaku tsuki (direct hit with the back arm), tsuri ashi (impulse in the back leg and forwarding), the movement is beginning at jiyu na gamae stance (advanced leg, easily flexed knees, legs have a distance equally to each of the subjects distance between arms, the torso is easily turned on the direction of the forwarded leg and arms are both in the heisoku dachi).

For the monitoring of the execution process has been used the MOVEN bands version equipment.

The used procedure was:

- The subjects were equipped with the MOVEN accessories, according to user manuals;
- The open acquisition session and recording of antropometric parameters of the monitored subject (height, weight, proper mass center, plant length, plantei, length between the arms);
- N-pose and hand-touch calibration
- MOVEN acquisition opening session
- Data acquiring (10 hits of gyaku tsuki on right, 10 hits of gyaku tsuki on left)
- Data acquiring and interpretation
- Conclusions.

In 2015, September, we have made a t-0 both experimental and control groups, then, the experimental group has been trained for 6 months by using on a certain training method, which included on each session stage certain coordination exercises, which have been applied both laterally or on the dispreferred karateka's stances. In 2016 March, we have been used the final test for both of groups.

The ambilaterality program was built upon the competition programme, according to yearly planning. The planning was created on a complex basis which incorporated all the types of training- physical, tehnical, tactical, theoretically and nonetheless, on a psychological basis.

We underlined the general physical training from 6 to 12 years old, but also on the specific training, according to the training interval. The ambilateral specific exercises have been used both on an effort basis and fundamental, too.

Insisting on the laterality importance, beginning with the 8 Kyu (yellow belt), we have been introducing both trainings and in examining program, the execution on both positions left and right. At our proposals, on the competitional matches of national sanbon kumite, the execution of the kihon- specific probes, has been made both for left and right positions, as advantage point in case of a draw.

Since the beginning, the technique has been reunited with the tactics, and it has been told each time the practical or learned technique, according to the Competitional Examination Rule Programme. We have been used the video recordings, the more advanced karate-ka demonstrations, practical applications (bunkai), in order to use in learn all of the visual, audio, kinestetic and tactile receptors, and for creating a complex experience in order to create a complex image related to reality.

In experimental data processing, both t-0 and t-final, consisted in comparison of cinematic parameters, which have been calculated for the execution both left and right for each subject (medium of 10 executions per each position left and right) and also the group medium comparison (as a statistic analysis). For the experiments lot subjects, the differences between the executions with the right and the ones with the left, they have been lowered at final testing, mainly because the cinematic parameter values have been decreased.

This decreasing of laterality difference has been made although increase of competition performances, as seen upon supervision of the podium points between 2015-2016. And so, the rating point increased from 117 to 121 and the rating experimental point increased from 189 to 399.

CONCLUSION

- 1. The laterality problem, as passing by into ontogenesis through several stages (unpredicted laterality, lateralisation and laterality around the age of 3 as a sign of a brain development and to an efficient communication between cerebral hemispheres, once with the development of the capacity to pass by the middle line and to be able to operate objects with the opposing members) remains of a large interest mainly between medical staff and psychologists.
- 2. The interest upon the sports regarding the term of bilaterality is narrated as a drawing efficiency which was given by bilateral executions with the same efficiency as acting and motion actions.
- 3. In case of the people who are chosing to make a certain sport, they will confront with the balancing the communication between cerebral hemispheres specifically to transfer the dexterity needed for the undominant body part, in order to achieve better results;
- 4. Practicing a sport has positive influences on the undominant body parts, as long as the trainings are conducted to that direction and on the other hand, if the sports implies both members equally;
- 5. Our training program, by use of the described method which includes in each training stage certain coordination exercises, which has been applied ambilaterally or dominant on the unpreferred body part upon the karatekas, it had given us the expected results by diminishing the difference between analysed gyaku tsuki calculated cinematic parameter techniques;
- 6. By lowering those differences between lateralities, we have had obtained a positive result by increasing the cinematic parameters on the dominant body parts, thus indicates us a visible progress of the undominant body part;

- 7. From that simple hitting analysis, we can obtain useful information regarding almost all of the body parts, if the MOVEN equipment is used as a movement reference;
- 8. As using only an arm technique, we are able to get information regarding both superior and inferior train and, furthermore, we are getting results upon links and coordination of the upper body with inferior train and to use in execution the long cinematic chains (as seen in experienced karatekas).

PARTICULARITIES

This is a premiere subject in Shotokan Karate discipline, even if in a couple of years there have been made some researches regarding laterality (as seen on both normal subjects and mostly pathology subjects), mainly because we are using the laterality technology of inertial movement being integrated into MOVEN equipment.

Nonetheless, data acquiring mode regarding both superior train (execution speed hit, segments movement speed, movement geometry, evidenced by intersegmentary angles) and inferior train (appreciation of a good exploding force hit and not just by using the legs, reflected both in speed of the coxal bone and in the flexing of the advanced knee angle), through analysis of an elementary technique from Shotokan Karate, remains an individuality of this case study.

Nevertheless, the training program which included in every step of training certain coordination exercises, which has been applied ambilaterally nor with dominance on the unpreferred body parts of karatekas was an original- one, created by us especially to lower the differences in executions on the left side and on the right side.