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European Journal of Experimental Biology, 2012, 2 (6):2444-2450

ISSN: 2248 –9215
CODEN (USA): EJEBAU

The effect of mental practice on response time via Nelson's speed of movement test

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ABSTRACT

The success of athletes in minor and major events can be attributed to the response time. The significance of response time is manifested when you witness that an athlete wins over a competitor only with a difference of fraction of a second in the reaction time or movement time. This study aims to investigate the effect of mental practice on response time, using Nelson's Speed of Movement Test. The subjects included 45 female university students who were randomly classified under three groups, after obtaining a satisfactory score in Motor Imagery Ability Test (n=15). The response time was measured and practiced by Nelson Speed of Movement Test and the scores for response time were recorded in two pre-test and post-test phases. The practices were carried out in 4 sessions based on which the physical practice group carried out the exercises practically, and the mental practice group carried out the exercises mentally and the mental-physical practice group firstly carried out the exercises mentally and then physically. The data analysis was carried out via one-way ANOVA and correlated t-test. The findings revealed that 4 sessions of combined mental-physical practices caused a remarkable progress in the response time for the subjects and after that the highest progress belonged to the metal practice group, as compared with the physical practice group.

Keywords: Mental Practice, Response Time, Nelson's Speed of Movement Test

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INTRODUCTION

From the very beginning of his life to the very end of it, man is frequently dealing with the learning process in several ways and he is permanently in the midst of learning the knowledge on different skills. Motor skills are among the skills the learning of which begins with our birth and it finds a specific significance during lifetime. Being responsible for transferring the skills from basic motor skills to very complex skills, physical education has obtained a specific position, so that focusing on the acquisition of motor skills, motor learning is considered as the heart of physical education and sport experiences. During the last few years, the researchers have attempted to identify the necessary information on the effective factors & multipliers of learning motor skills. Although motor learning will not be realized unless practical exercises are carried out, there are some methods that the coaches and athletes consider as the supplements of practical exercises for a better and faster learning of the skill [6]. One of the

most significant methods is mental practice. In this method the learners are asked to review the skill in their mind without performing it practically. In this mental practice, sometimes referred to as mental review, the athletes are asked to think about the skill they are learning. They review different steps of doing it and imagine that they are performing it successfully and even they win the championship [1]. The philosophy behind the emergence of sport psychology as a branch of psychology is directed toward facilitation of teaching motor skills by the coaches to the learners. In this regard, a method introduced by the researchers and proved to be effective is the application of imagery that is used as a supplementary activity in line with learning sport skills in the absence of apparent physical movements or together with them. Undoubtedly, many sport skills demand the performance of the skill as fast as possible, as the key to the success of the athlete [4]. Speed is the ability of an individual in pushing forward or moving the whole or a part of body in the space in the shortest possible time, such as: the speed of a wrestler in pushing the hand forward in order to perform a wrestling technique; the movement of hand by a weight thrower; the movement of legs by a swimmer; and the movement of hands by a karate champion. Reaction time includes the interval between receiving the stimulus by the limb and reacting to it. There are many factors involved here, some of which include: the stimulus intensity, the sensory nerves of the stimulated limb, the motor nerves of the responding limb, practice, fatigue, motivation and the health status of an individual. Though it's quite difficult to dissociate the speed of movement from the reaction time, these two factors are not necessarily present in one individual. These two factors might be sometimes assessed separately and the acquired results might be compared and there might be a low correlation coefficient between the scores obtained in the test; however, it is not possible to separate these two factors from each other, in performing one movement. Though it may be necessary to assess these two factors separately for some certain purposes or for some researches, the coaches and champions are recommended that the best and the most practical thing is to assess these two factors together, as these two are interdependent in performing the activities.

The success of athletes in minor and major events can be attributed to the response time. The significance of response time is manifested when you witness that an athlete wins over a competitor only with a difference of fraction of a second in the reaction time or movement time. The studies carried out so far have focused on simple reaction time and choice reaction time and no considerable amount of works have been carried out on response time. Moreover, the observation of the contradictory results on the effects of practice on reaction time and speed of movement made the researcher to try to investigate the effect of mental practice on response time and that whether merely a mental practice can affect the response time or not. Will physical practice by itself or the combination of mental and physical practice affect the response time?

There are several definitions for mental practice some of which are mentioned here. Mental practice means that the athlete reviews the skill without actually performing it and he/she imagines that he/she is performing it successfully and even that he/she wins the championship. In 1989, Magill limits the term "mental practice" only to the situations where an individual imagines a skill or a part of it. Generally speaking, imaginary is a mental process (Murphy & Jowdy, 1992) or a thinking method (Heil, 1992). On the other hand, mental practice is defined as the use of imagery for practicing the skill mentally. It should be noted that mental practice is: "the cognitive rehearsal of a physical skill in the absence of apparent physical movements" (Magill, 2002).

Internal imagery: imagery about the performance of a skill from a first-person perspective. External imagery: imagery about watching oneself as an external spectator [5]. Hale, Harris & Robinson, and Baker et al realized that the internal imagery of a movement stimulates the muscles remarkably more than external imagery for the same movement. The researchers also suggested that physiological responses to internal imagery are more similar to the real practice, as compared with the external imagery [5]. There is a shared nervous mechanism between mental practice and physical practice and the time required for the performance of an activity is equal to the time needed for imagining the same activity. On the other hand, when an activity becomes more difficult, the required time for performing what is mentally imagined also increases [6, 19].

Moreover, in various situations of life, such as workplace and many fields of sport (such as table tennis where response time for responding to the competitor is highly significant) or even for the military men, it is not only the reaction time that is important, rather the movement time is also highly significant, since in such situations the individuals should not only make a decision on what to do but they also have to perform that action. Therefore, it is sometimes necessary to assess a combination of both of these factors that indicate the response time [18].

Response time: response time consists of two components: reaction time and movement time. Reaction time is the time required for the assessment of the stimuli, choosing and launching the response; however, movement time is the time required for the performance of the motor response [16]. Indeed, a combination of these two factors of reaction time and movement time is called response time. Reaction time starts when the stimulus is discovered and

ends when the action is started; response time begins with the presentation of the stimuli to the completion of any required response [23].

Shanks and Cameron concluded that despite the previous evidences indicating that mental review leads to the improvement of performance in many perceptual motor tasks, this study showed no effective results for none of the two mental practice groups, that is to say actually no effect was observed as resulted from mental practice, which was surprising. However, the chain task reaction time showed a reliable increase for the physical practice group [22]. The reduction in the reaction time through mental practice was the title of a research carried out by Grouius. He concluded that mental practice can directly affect the mental system in a significant way, because it is a strong cognitive activity that can directly affect the memory and so it can cause a mental comparison or more significant response choice processes [13].

Brouziyne and Molinaro revealed that the novices could obtain the skill of performing golf shot. Among the three groups, the highest level of improvement and progress was achieved by the combined physical and mental practice group. Mental practice can effectively cause motor improvement and performance, even in the novices [9].

In a research carried out in 2007, the subjects performed the movements that merely dealt with the upper limbs of body (such as eating) and the movements that involved the whole body (such as swimming) while mental scanning was being carried out on them. The results revealed that imagery of both of these two movements leads to the bilateral activation of the internal and external pre-movement cortex in the parietal lobe. Therefore, the findings of this research support this claim that motor imagery of the simple and unpracticed movements can be extended to real and more complex situations. This study suggests that mental practice can effectively improve motor skills with similar mechanisms such as apparent practices including frequent activation of the cortical areas coded for this movement. Finally, it concludes that motor imagery for the daily routine movements directs a cortical network such as the network involved in very simple movements such as finger kicks [24]. R. Gentili, C. Papaxanthis and T. Pozzo also suggested that the hand movement time and the maximum speed for the right path (the practice path) decreases and increases, respectively, after both mental and physical practices in the right path. While the improvement of motor performance after physical practice was higher than mental practice, mental practice facilitates motor learning, and motor prediction, as a common process both in real and imagery (mental) movements, is an essential function for sensorimotor control as well as learning [12].

When an individual begins the mental imagination of a practice, similar to the status of performing that activity [15, 25], the movement patterns are reconstructed and all processes involved in preparation and motor planning are also being activated in this mode. The main difference between mental practice and physical practice is related to the performance of physical practice. Carpenter states that physical and mental practices have the same quality but different quantities [5]. Another reason for a shared nervous mechanism between mental practice and physical practice is that the time required for the performance of an activity is equal to the time that the individual spends on imagining the same activity. On the other hand, when this activity becomes more difficult, the time required for imagining the performance also increases [15, 17]. Mental practice (motor imagery) is very useful for the rehabilitation of the patients with motor skills disorders in order to facilitate their performance in the future and it is currently considered as a topic developed in the motor imagery researches [11, 20].

Speed of movement and reaction time are two inseparable parts and both of them can be improved and progressed via various practices and activities. Generally, speed is measured by sprinting. However, distances longer than 100m are not suggested for the assessment of speed, because there are other factors that are effective in these distances. Evaluation and measurement of reaction time costs a lot and there are many problems for it. To measure the reaction time, many devices have been devised, usually including a lamp and a switch. The subject pushes the switch immediately after the stimulus and as the lamp turns on, a chronometer measures the time interval between the stimulus and the response. Nelson devised several cheap devices for this purpose that are both precise and effective [4].

MATERIALS AND METHODS

This is a semi-experimental research and the statistical population includes 120 19- to 21-year-old female students of Amirkabir University of Technology (Tehran Polytechnic) who were passing the course of general Physical Education I in the second semester of academic year 2007-08. 45 of the female students of Amirkabir University of technology who had been successful in completing the motor imagery questionnaire were selected for this research. They were classified under three groups each one including 15 subjects, based on a simple random sampling method. The subjects were non-athletes and unfamiliar with Nelson's Speed of Movement Test and mental practice.

Instrumentation
The instruments used in this study consist of personal consent form, including some questions on personal matters, revised Movement Imagery Questionnaire by Hall & Martin (1997) by which the data on the imagery potentials of the subjects is obtained (table No. 1), Nelson's Time Scale Ruler [3] and Nelson's Speed of Movement Test [3].

Test Implementation Method
When MIQ was implemented and 45 subjects were selected, the subjects were randomly classified under 3 separate groups each including 15 subjects (mental practice group, physical practice group, mental-physical practice group). Then, the purpose and implementation method for the test was separately explained to the subjects in each group and they were asked not to explain their practice program for other groups. Prior to the pre-test, all subjects were allowed to work with the tool (Nelson's Ruler) for 20 times. Then all subjects took the pre-test. Later they were asked to attend the class for 4 sessions (every other day) to perform the practices just like other members of their group. All subjects were unfamiliar with the process and had already carried out neither mental practice, nor Speed of Movement test (table No. 2).

RESULTS

Statistical Methods and Research Findings
ANOVA was used to compare the time of implementation for different groups (table 4). Correlated t-test was used to compare the time means for the implementation of pre-test and post-test by the groups (table 3).

First Hypothesis
Null Hypothesis: Physical practice has no significant effect on the response time for the subjects.

After the implementation of correlated t-test and the extraction of the results in table 3, the research hypothesis stating there is a significant difference between the response time for the subjects prior to and after the implementation of physical practice was verified. In other words, the implementation of physical practice improves the response time for the subjects (table 3).

Second Hypothesis
Null Hypothesis: Mental practice has no significant effect on the response time of the subjects.

Based on the *t* value measured in table 3, the null hypothesis is rejected and the research hypothesis indicating a significant difference to exist between the response time of the subjects prior to and after the implementation of mental practice is verified. In other words, the implementation of mental practice improves the response time for the subjects.

Third Hypothesis
Null Hypothesis: Mental-physical practice has no significant effect on the response time of the subjects.

Based on the *t* value measured in table 3, the research hypothesis indicating a significant difference to exist between the response time of the subjects prior to and after the implementation of mental-physical practice is verified. In other words, the implementation of mental-physical practice improves the response time for the subjects.

Generally speaking, comparing the pre-test and post-test results for all three experimental groups, it was observed that there is a significant difference between two tests. That is to say that the mean response time improved in all three groups.

Fourth Hypothesis
Null Hypothesis: There is no significant difference between the changes in the response time of the subjects after the implementation of different (physical, mental and mental-physical) practices.

After the implementation of ANOVA on the difference between response time of the subjects in the post-test and pre-test phase, it was observed that the *F* value obtained from test (6.323) is significant at the level of 0.004 ($P \leq 0.05$) (table 4). Therefore, there is a significant difference between the response time of three groups after the implementation of physical, mental and mental-physical practices. As a result, the null hypothesis is rejected and the research hypothesis indicating the existence of a significant difference between the response times of the subjects is verified after the implementation of physical, mental, and mental-physical practices.

A review of the hypotheses revealed that the overall practices performed in all three groups resulted in the progress in their performance. The mean response time improved in all three groups and the mental-physical practice group showed a better progress among all three groups. Mental practice group also showed a better progress, as compared with the physical practice group.

Table 1. Mean, SD and record Ranges for Age and Imagery Ability of Subjects

Personal information Group	Age			MIQ		
	X	SD	Min-Max	X	SD	Min-Max
Group I, Physical Practice	19.461	0.634	19-21	50.07	1.492	48-53
Group II, Mental Practice	19.692	0.722	19-21	50.85	2.558	46-54
Group III, Mental –Physical Practice	19.857	0.515	19-21	51	3.505	46-55

Table 2. Mean and SD for response time of three experimental groups in two tests

Response Time Group	Pre-Test		Post-Test		Number
	X	SD	X	SD	
Group I (Physical)	0.2480	0.0198	0.2239	0.0206	13
Group II (Mental)	0.2716	0.0153	0.2268	0.0105	13
Group III (Mental-Physical)	0.2663	0.0275	0.2166	0.023	14

Table 3. Data of the correlated t-test

Change Sources	Measurement Phase	Mean	SD	t	Degree of freedom	Significance
Group I (Physical)	Pre-test	0.248	0.019805	3.871	12	*0.002
	Post-test	0.224	0.020570			
Group II (Mental)	Pre-test	0.272	0.015341	12.428	12	*0.0001
	Post-test	0.227	0.0104789			
Group III (Mental-Physical)	Pre-test	0.266	0.027498	8.442	13	*0.0001
	Post-test	0.217	0.022959			

∗ Significant at the level of ($p \leq 0.05$)

Table 4. The results of ANOVA on the differences of response time in pre-test and post-test

Change Sources	Group	Mean	SD	t	Degree of freedom	Significance
The difference in the response time in pre-test and post-test	Physical Practice Group	0.0241	0.022	6.323	2	*0.004
	Mental Practice Group	0.0448	0.013			
	Mental-Physical Group	0.0497	0.022			

DISCUSSION AND CONCLUSION

Feltz (1983) and Drexel (1994) concluded that mental practice influences on the learning of cognitive and motor activities; however, it has a greater effect on learning the cognitive activities [14]. So, the more the skills enjoy cognitive factors, the more useful the mental practice will be. Since the information processing is also a mental process that affects the response time, it also follows the same rule. Mental imagery and practice is an activity related to the nervous system and it can have a direct influence on memory and so it results in the progress in performance [10]. Moreover, according to Feltz and Posner, the efficiency of mental practice is dependent on the tasks with a wide range of cognitive elements, such as darts, free throws in basketball and sports including a target, because they need a high level of coordination between eye and hands as well as a delicate motor control [3].

The study of the response time for the pre-test and post-test in the mental practice group revealed that mental practice has a positive impact on response time so that it improves the response time of the subjects. The symbolic Learning Theory indicates that the more prominent the cognitive elements, the better and the faster the learning via mental practice. Walter and Viali also believe that a mental plan is formed in the mind for the implementation of a skill during the physical practice, and as a result, it helps the storage and retention of that skill. Mental practice can also create such a plan, and as a result it will accelerate the learning process. Feltz (1983) and Drexel (1994) concluded that mental practice affects the learning of cognitive and motor activities, but it has a great effect on the learning of cognitive activities. So, more cognitive elements involved in implementation of skills will lead to a higher effectiveness for the mental practice. Since the information processing is also a mental process that affects the response time, it also follows the same rule. Mental imagery and practice is an activity related to the nervous system and it can have a direct influence on memory and so it results in the progress in performance [13]. Moreover, according to Feltz and Posner, the efficiency of mental practice is dependent on the tasks with a wide range of cognitive elements, such as darts, free throws in basketball and sports including a target, because they need a high level of coordination between eye and hands as well as a delicate motor control [3]. Since the subjects enjoyed a desirable level of motor imagery ability and the task practiced here was also a cognitive task, the subjects achieved

the highest level benefit from the mental practice. As a result, it can be said that mental practice is a cognitive activity and it influences the response time, i.e. a cognitive task.

The utilization of mental-physical practice showed the highest effect, in comparison with other two groups. This supports the results obtained by Landers et al (1996) indicating that implementation of mental practice and then physical practice yields a more desirable result for the skill improvement for free throws in basketball, as a task with a wide range of cognitive elements (according to Fitz & Posner). Sariveg (1995) concluded that a combined application of mental and physical practice has the highest effect on learning. Therefore, the results of this study for a combination of mental-physical practice support the results of studies carried out by McBride and Ratstein (1979), Feltz & Landers (1983), Legion & Decker (1994), Sariveg (1995), Landers et al (1996), Savi (1996), Feltz et al (1998), Brouziyne & Molinaro (2005). The comparison between physical practice (Group 1) and mental practice (Group 2) revealed that mental practice had a more desirable effect, as compared with physical practice. These results do not support the results reported by Denis (1985), Grouius (1992), Gentili, Papaxanthis & Pose (2006) and many other researchers. This disagreement might be due to the fact that based on the Attention-Arousal Theory indicating that by mental practice an individual will be able to learn his/her physiologic arousal at an optimum level and mental practice can draw the attention from irrelevant thoughts to the considered task, the members of the physical practice group have not been able to focus sufficiently on the considered task. Moreover, they probably have experienced a lower level of arousal, compared with other two groups. Din Timon also found out, about the personal motivation for speed of movement and reaction time, that motivation plays a significant role in improving these two factors of response time [7]. Another reason is that the fatigue resulted from physical practice might have resulted in the loss of motivation in the physical practice group. Perhaps, the low level of performance in the physical practice group is resulted from the lack of progress or even the regression with regard to the reaction time. The reason behind this conclusion is that the inheritable and cognitive nature of the reaction time has been formerly focused and based on many researches on the mental practice, mental practice has a cognitive nature and has a higher effect on the tasks with cognitive elements. Since cognitive practice is not carried out in the physical practice group, the performances of this group have been poor, and two other groups that enjoyed the cognitive practices related to the skill showed a progress in their performance. Possibly, four sessions of practice have not been sufficient for the physical exercise group to overcome the cognitive problems with regard to the movement. The question “Is mental practice as effective as physical exercise?” has been answered by Schmidt and Lee in their book in this way: according to the results of studies carried out by Feltz & Landers (1983) and other researchers it should be said that although mental practice group showed better results in all modes, in comparison with control group that was involved in irrelevant tasks or other practices, this group received a lesser degree of effect, as compared with physical practice group [21].

Despite the results obtained by these researchers revealing a lower effectiveness for the mental practice, the results of this research showed that mental practice has a remarkably higher effectiveness than physical practice. This should be subject to further studies. These results should only be applied to the tasks similar to the one used in this study, i.e. not involving so much motor elements. The type of practice might have not been appropriate for measuring and practicing the response time, because it had limited motor elements and so it cannot be generalized to include other sports and it can only be extended to pistol shooting and sports like that.

Generally the results of this study verify the following facts:
1. Mental practice is an effective method for improving the response time.
2. Combined mental-physical practice is more effective than separate physical and mental practices.
3. Mental practice showed better results than physical practice alone, with regard to the improvement of the response time.

Generally speaking, the investigation of the results of this research and other researches reveals that mental practice has a great positive effect on the response time. As a result, it can be used to achieve the athletic objectives and progresses more rapidly. This method is simple, easy, inexpensive and available, and it also puts the individual in a desirable mental status either in learning process or in participating in matches.

REFERENCES

[1] Ahola, Aso, Hatfield, Brad. *Sports Psychology: A Sociopsychological Approach*. Translated by Reza Fallahi & Mohsen Hajiloo, Tehran: Physical Education Organization Publications, Research Department, 2nd Ed., **1993**
[2] Rajaeian, A. *The Effect of Mental Practice on the Balance in Students*. M.A. Thesis, University of Urmia, **2006**.
[3] Salami, F. & Bahram, A. *Motor Learning*, Tehran: Payam-e Noor University Publications. **1996**.
[4] McMorris, T. *Acquisition & Performance of Sport Skills*. Translated by Dr. Rasool Hemayattalab & Abdollah Ghasemi. Tehran: Bamdad-e Ketab Publications, 1st Ed. **2007**

[5] Magill, *The Role of Mental Practice in Motor Skills Learning*, Translated by Fatemeh Salami, Sports Quarterly, No. 19
[6] Vertstein, A. Galter, E. *Motor Learning*. Translated by Mohsen Bolourian. Tehran: Ministry of Education Publications, Department of Physical Education. Tehran, **1995**.
[7] Hadavi, F. *Measurement & Evaluation in Physical Education*. Tehran: Tarbiyat Moallem University. **1998**
[8] Izanloo, Z. *The Effect of Sequence of Mental Practice in Acquisition, Retention & Transfer of Cognitive Motor Skills*. M.A. Thesis. Tehran University. **2007**
[9] Brouziyne.M, Molinaro.C, **2005**, Mental imagery combined with physical practice of approach shots for golf beginners, *Perceptual and Motor skills*, 101,203-211.
[10] Deschaumes.C, Molinaro.C, Dittmar.A, Vernet.E, Maury.E, **1991**, Relationship between mental imagery and sporting performance, *Behav.Brain Research*, 45, 29-36.
[11] Deschaumes.C, Molinaro.C, Dittmar.A, Vernet.E, Maury.E, **1992**, Autonomic nervous system response patterns correlate with mental imagery, *Physiology Behaviour*, 51, 1021-1027.
[12] Gentili.R, Papaxanthis.C, Pozzo.T, **2006**, Improvement and generalization of arm motor performance through motor imagery practice, *Neuroscience*, 137, 761-772.
[13] Grouius.G, **1992**, On the reduction of reaction time with mental practice, *Journal of Sport Behavior*, 15(2), 141-157.
[14] Guillot.Aymeric, Collet.Christian, **2005**, Contribution from neurophysiological and psychological methods to the study of motor imagery, *Brain Research reviews*, 50, 387-397.
[15] Haier.Richard J, Jung.Rex E, Yeo.Ronald A, Head.Kevin, Alkire.Michael T, **2005**, Cognitive Affective & *Behavioral Neuroscience*, 5(2), 246-251.
[16] Hainaut.J-P, Bolmont.B, **2005**, Effects of mood state and anxiety as induced by the video-recorder stroop color-word interference test in simple response time tasks on reaction time and movement time, *Perceptual and Motor Skills*, 101, 721-729.
[17] Lafleur.Martin F, Jackson.Philip L, Malouin.Francine, Richards.Carol L, Evans.Alan C, Doyon.Julien, **2002**, Motor learning produces parallel Dynamic Functional changes during the execution and imagination of sequential foot movements, *Neuroimage*, 16, 142-157.
[18] McMorris.Terry, Tallon.Mark, Williams.Craig, Sproule.John, Draper.Steve, Swain.Jon, Potter.Julia, Clayton.Nevilie, **2003**, Incremental exercise,plasma concentrations of catecholamines,reaction time and motor time during performance of a noncompatible choice response time task, *Perceptual and Motor Skills*, 97, 590-604.
[19] Personnier.Pascaline, Paizis.Christos, Ballay.Yves, Papaxanthis.Charalambos, **2008**, Mentally represented motor actions in normal aging II. The influence of the gravito-internal context on the duration of overt and covert arm movements, *Behavioural Brain Research*, 186, 273-283.
[20] Poolton.J.M, Masters.R.S.W, Maxwell.J.P, **2006**, The influence of analogy learning on decision-making in table tennis:Evidence from behavioural data, *apsychology of Sport and Exercise*, 7, 677-688.
[21] Richard A.Schmidt, Lee.Tim, **2005**, Motor control and learning, Behavioural Emphasis, 4TH Edition, Human Kinetics.
[22] Shanks.David.R, Cameron.Annabel, **2000**, The effect of mental practice and performance in a sequential reaction time tasks, *Journal of Motor Behavior*, 32, 3, 305-313.
[23] Sigmundsson.H, **2005**, Do visual processing deficits cause problem on response time task for dyslexics? , *Brain and Cognition*, 58, 213-216.
[24] Szameitat.Andre J, Shen.Shan, Sterr.Annette, **2007**, Motor imagery of complex every day movements:An fMRI study, *NeuroImage*, 34, 702-713.
[25] Wuyam.B, Moosavi.S.H, Decety.J, Adames.L, Lansing.R.W, Guz.A, **1995**, Imagination of dynamic exercise produced ventilatory responses which were more apparent in competitive sportsmen, *Journal of Physiology*, 482, 713-724.