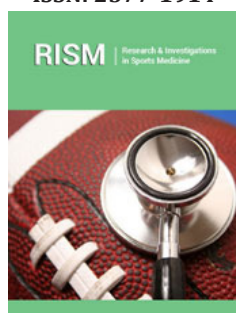


# The Concepts, Theories and Measurement Tools Handedness in Sports

**Javad Alizadeh, Hadis Zaferanian and Mohammadbagher Forghani OZRUDI\***

Department of Physical Education, Iran

ISSN: 2577-1914



**\*Corresponding author:** Mohammadbagher Forghani OZRUDI, Department of Physical Education, Iran

**Submission:** February 02, 2019

**Published:** March 26, 2019

Volume 4 - Issue 5

**How to cite this article:** Javad A, Hadis Z, Mohammadbagher F O. The Concepts, Theories and Measurement Tools Handedness in Sports. Res Inves Sports Med. 4(5). RISM.000597.2019. DOI: [10.31031/RISM.2019.04.000597](https://doi.org/10.31031/RISM.2019.04.000597)

**Copyright@** Mohammadbagher Forghani OZRUDI, This article is distributed under the terms of the Creative Commons Attribution 4.0 International License, which permits unrestricted use and redistribution provided that the original author and source are credited.

## Abstract

Hand of Excellency is one of human features that is defined as the unequal distribution of proper motor skills between left and right hand. In investigation of the effective elements that cause the Excellency and dominance of one organ over the other organs, many studies and researches from the past have been proceeded that in this research, it is tried that some of them be implied. The aim of this research, is stating of concept and theories and the advantages of hand of excellency that can have many effects in sport, the theories of hand of excellency include of theories of bio-knowing, bio- environmental theories, meta sound theory, theory of being heritage of hand of excellency, theory of social pressure of parents and sociology theory of hand of excellency. Finally, the tools of measuring of hand of Excellency state that each person with this test can find that in which one of the groups of hand of Excellency is located.

**Keywords:** Hand of excellency; Ambidextrous

## Introduction

Motor learning as a relatively permanent change in behavior is defined as the result of practice and experience. Measuring the sustainability of progress in practice that has been achieved by training and measuring the adaptability of changes in performance in new situations are the methods of learning inference [1]. Athletes must exercise athletes in sports, tournaments and games. Instructors Because of these executive needs, the training conditions must be designed and organized so that they can be more successful in future implementation [2,3]. The excellent hand is a vague term and can have different meaning for many of people. Most people in our society define the excellent hand as a hand used for writing. In academic societies, the vagueness of this term has caused many discussions. The researchers define excellent hand as the basis of different theoretical assumptions. For example, some define the excellent hand as: A hand that operates faster or more precise in manual tests. While, the other defines it as: A hand that by ignoring of the operation, for one person, while using has the priority [4].

"Hand of excellency" is one of the human feasters that is defined as the unequal distribution of proper motor skills between left and right hand [5]. The person who has more skill and agility with right hand is said right-handed and the person who has more skill with left hand, is said left-handed. Minority of people have equally proficiency with both of two hands for doing of their activities and such people are called "Ambidextrous". The people who show abnormality for using of both of two hands, are called ambilevous or ambisinister. The ambilevous skills or low level of agility may lead to unability of bodily and physically conditions [6].

## Methodology

The present study was a simple overview and the search of articles was done in the Iranian and international databases Science Direct, PubMed, Cochrane library, Scopus, Iranmedex and Google Scholar with the keywords of Hand of Excellency, Sport, Concept and within the time frame of 1975 to 2017. The criteria for entering articles include studies published in Farsi and English, studies conducted on diabetics, and intervention studies conducted on the basis of the Hand of Excellency, Sport approach.

## Result

### Types of hand of Excellency

There are exist four main types of hand of Excellency.

**Excellent right-handedness:** Excellent right-handedness is more common. The right-handedness people, while doing the assignments and duties, have the more skills and agility with right hand.

**Excellent left-handedness:** The excellent left-handedness is less common than right-handedness the people with excellent left-handedness in doing of the activities and duties, have more skills and agility with left hand. About 8% to 15% are left-handedness people.

**Mixed-handedness:** These are people who do different activities with different hands, for example such people may write with right-hand. But with left hand, throw the ball with more efficacy than the right hand toward the target. This many of the authors define the excellent hand through a hand which is used for writing. So, most of the times, the mixed hand of Excellency is ignored.

**Ambidextrous:** The ambidextrous people are very rare, however, being ambidextrous can be learnt. A real ambidextrous person is a person who has the ability of doing of duty and activities with both of two hands equally of goodness of each other. The people who learn to be ambidextrous tend yet to own main dominant hand [7].

### Effective element in Excellency of an organ

In investigation of the effective elements that cause Excellency and dominance of an organ over another organ, many researches and studies have been proceeded that in this research it is tried to imply to some of them. As we know, the peripheral dominance that means more using of one hand or one eye, appears often in the early years of life. Determination of the careful time of it is to some extent difficult but in the given conditions, the children like to use their non-dominant organ. In contrary, the adult and adolescence usually prefer to use their excellent hand. The Excellency of hand is even seen in newborns, the newborns, before 3 months, keep the object in a long term and keep one their hand fist in a more time. Some newborn that try to turn they're toward the right side, seem that prefer approach to the object with right hand and vice versa, these self-gender experiences may cause facility of integration of eye and hand of one side of body more than the side.

The proceeded studies and experiments show that at the low level of life, there is a stage of framing that gradually being peripheral of brain comes after it and probably is completed about 6 years in a much amount. About the peripheral excellency, although the children in 3 years old have understanding about the peripheral dimensions (up, down, front, back), but understanding of this matter that their body has two completely specified side of left and right, is achieved about 4 to 5 years. The aging advance about ability of determining of dimensions has importance [8]. Lindbergh (1960)

achieved the documents and witness that show the direction and direction of direction of actions of brain during the time grow and, in the puberty, period reaches to the completeness limit, in his view, the excellency starts gradually at the time of language acquisition and probably doesn't appear up to end of puberty in a complete form.

the proceeded experiments on the brain about one direction of the functions of two hemisphere of marrow state that the left hemisphere has generally excellency in verbal functions like verbal understanding and stating, reading and writing, thinking, verbal memory, understanding and order of members, understanding of the matters that in a manner on the skin and also in muscular adjusting of speech. On the other hand, about the functions like the non-verbal processing, visual and touching, identification of shapes and designs, space adjusting of numbers, space and directing understanding, music and non-verbal sounds understanding, the bodily sensory identification and up to the extent the speed of reaction, the excellency is with the right hemisphere.

A. By attention to the operation of hemisphere of brain and the effective elements in Excellency of one of the hemispheres and consequently, the Excellency of one organ of body against the other organ, we reach to this conclusion that:

B. The heritage and genetic element are a determining element in Excellency of one hemisphere and one organ, I.e. his/her brain hemispheres got intuitively, so in the next stages, the excellent organ is used until that organ in doing of works be dominant is preferred.

C. Injury and/or damage of one organ that in this case, the person preferentially uses the other organ and that organ in doing of works will be dominant and/or the special conditions like effects (Ultrasound) that cause the change in dominancy of one hemisphere Ghaemi J [9].

D. The society element can also be dealt in this matter. In society, some of people insist that the children use more their hand even if the child be intuitively left - handed (the cultural element affective on the hand of Excellency).

While the right hemisphere of child be excellent, under the environmental pressures is forced to use his/her right hand and in doing of the works that is not under the attention of others like playing with toys, uses the left hand [10]. Brown Jeff, about the reasons and root of Excellency of one of hand states some factors that are implied in following:

- A. Heritage
- B. Inborn aspects
- C. Brain cause
- D. Social cause

Bab cock believes in this case that this case i.e. preferring of one side of body over the other side, is not only based on curiosity but may be based on the division of the many brain operations of organisms in the left or right side. Bab cock says, about the ani-

mals that have bilateral symmetry, a simple work like walking is not practically possible unless one side be pioneer. Baser presents the differences from the point of view of time and quality of the effect of growth stages but finally knows the age in this case up to 5 years. By raising of the age, the level of direction of Excellency will be increased [11]. John Dayn in 1989 states one of the principles of motor development in children as the completeness of being bilateral to bini-lateral and writes after 4 years, children normally prefer to use more one side of body in activities. So, the child may eat food or paints with right hand and/or may look with right eye among the shaping pipe (ibid).

Some studies that examine the difference in hand-up have suggested that left-handed players are likely to have some sort of intrinsic neural advantage and have shown that the volume of the central groove material, the gray left side of the brain is more than the right of the brain [12,13] in a study of male handball players showed that there is a significant difference between left- and right-hand players at the time of the reaction, so that the left hand of time has a shorter response [13]. Investigated athletes and showed that left-handed athletes had a shorter reaction time than right-handed athletes [14]. Gursay [12] showed that left-handed hands have an intrinsic superiority to the right-handed ones in relation to spatial motor skills. The relatively high number of male and female athletes at the highest level indicates that inner superiority [12].

### Work division of brain hemisphere

Work division normally accepts the theory of hand Excellency. The proven hypothesis from this theory is that when both speaking and work with hand needs to the proper motor skills, doing of two works by one brain hemisphere is more effective than division of work between two hemispheres. Also, if all functions and duties be done by two hemispheres, the size of brain and energy consumption will increase that this work is not operational. Because in many of people, the left side of brain (brain's left hemisphere) controls the action of speaking, so the excellent right - handedness is dominant in society. It is also predicted that the left - handed people, the division of work of their brain is riverside.

### Theories of Hand of Excellency

The new theories of hand of Excellency look at the hand of Excellency in different manner. The new view is that the hand of Excellency is not only Excellency of one hand, because both hands in most skill full and precise works practically with each other. For example, while writing it is not a simple pattern from one hand that has dominance and writes on one paper. For right - handed people, it is involved in an important manner: The left-hand guides and grasps the paper hardly and provides the field of doing of the operation of writing for the right hand. So, in this example, right hand appears as the specified hand for finer movement and the left hand widely for contextual movement [15].

### Bio-understanding theories

There are storing documents that before birth, Testosterone is secreted and distributed. One theory is that the high level of Testosterone before birth, causes appearing of left-handedness. This

subject can be the reason of this matter that why the left-handed men are more than the left-handed women and also the increase of appearing of left-handedness in boy twins. Some of such proceeded studies, know the probability of appearing of hand of Excellency very near the time of pre-birth and in mother's uterus that is indicative of bio-understanding procedure. For example, in one study of the ultrasound study from fetal thumb it is shown that 9 to 10 fetuses, sucked the thumb of their right hand. The new births show the excellences of one side of body over the other side. In study, 65% of children, in the response to the returning to the theft, while lying, returned their head toward the right. 15% of them preferred to return their head toward the left and remaining 20% don't show any Excellency. This Excellency in right or left is associated to the hand of Excellency that has been previously grown [16].

### Bio-environment theories

The main assumption of this theory is that the Excellency of left-handedness is result of the brain damages during the process of birth. Some of the statistical numbers support this theory. The stressful or hard births are common among the children that have grown left-handed or ambidextrous. The stress of birth is also with some deficiencies of birth and side-effects like: Cerebral palsy and autism. The medical and midwifery technologies for lowering and decreasing of the proportion of left-handed people have failed. In support of this idea that the usual and continuously of mid wifely for newborns is stressful. The usual and continuous obstetric monitoring in hospital for decrease of risk, don't show improvement of results, but also show the increase of using of the midwifery intervention while production process [17].

The usual intervention that cause the stress of children during birth include different forms of anti-ache drug, limitation of mother's movement, limitation in food and drinking of mother, antibiotics during work, frequently electronic fetal supervision, artificial interruption of shell, direct pressure or pressure in the mood of open are, many usage of clamp for releasing of parturition, making optional of caesarian section, separating of child from mother and being un-emergency of the current methods of birth of newborn. [18,19].

### Ultrasound theory

A known theory is that the ultrasound scans may affect on the brain of unborn fetus and make increasing of the excellent left-handedness in the newborns that were under the effect of the ultrasound scans, relative to the people were not under its effect. This theory is associated with such studies that have researched about his topic [20]. One of the authors claims that "we found a probable correlation between Ultrasonography in the inside of uterus and the consequences of non-excellence of right-handedness among the children in elementary school". Therefore, later in similar articles, the authors state that: "the correction may be result of chance" and "the result was not meaningful ... it is impelling that the studies had not enough statistical power to prove the correlation between ultrasonography and the consequences of left-handedness in children".

## Theory of being heritage of hand of excellency

In the year of 2007, the researchers discovered the first gen that was related to the increase of presence of inequality of left-handedness. The researchers also achieved the documents that having given form of this gene, to some extent causes the mental illness like schizophrenic [21]. Thus, the hand of Excellency is not simply heritage. Even when both parents are left-handedness, there is only 26% chance for existence of left-handedness children. This proportion is high enough up to when the members of a family are randomly left-handedness this matter can be seen as the heritage feather. For example, many of the members of the British royal family are left-handedness, are their fame caused that the probability of being heritage of the left-handed of Excellency is presented. When the strong family have Excellency of left-handedness, they don't feel a pressure for conflicting with normality, but instead may communal their difference and discrimination that causes the reverse prejudice.

One of the myths of people for left-handedness of Excellency associated to the genetic, is clean Kerr family. The magnate Kerr with dominant left-handedness, Scottish, built a building with the stabilities by spiral steps that had the rotation against the direction of hour hand, since the left-handedness swordsman can have defined better from himself. So, a study in 1993 didn't see any meaningful increase in left-handedness between the people with family Kerr or Carr [22]. The current most disputable etiology of left-handedness is the damage-knowing of left-handed. The left-handed form almost between 20% to 29% of the mentally retarded. It is believed that among such people, both left-handedness and mentally retarded. The brain damage of the left hemisphere of their brain because of the prenatal or postnatal events. Also, the shortage may cause the interruption of left-hemisphere. If the region of verbal processing in the left hemisphere of brain in the early of life be damaged, even a little in the right hemisphere, gets the responsibility of the function of verbal processing with the other functions of the hemisphere the second type of left-handedness is genetic or natural left-handed.

Such people have natural functions but their processing language in more probability (at least to some extent) is in their right hemisphere. The third type of left-handedness is learning left-handedness. Such people write with left-hand but have relative bad hand writing and have the double hemisphere motivation during major process. Because concurrent with start of speaking in children, there is no Excellency for using of given hand, such left people may at first randomly play with some of toys with their left hand skillfully and for skillful playing with toys continue using of left-hand. When randomly, because of maintaining of past, got a pencil or color pencil with their left-hand, may continue the using of left-handedness, even when they may be naturally tight-handedness [23].

## Theory of social pressure of parents

This theory explains the dominance of right-handed through this claim that because mostly are right-handed, the pressure of parents, the teaching of this behavior is considered normally. This

idea assumes that the environment pressure can be dominant on the genetic tendency because the percentage of left - handed really changed. In other word, a study showed that his excellent hand of the children selected for sample was not consisted with the excellent hand of the parents of adoption but was associated with the excellent hand of bio-parents [16]. This idea of "education through the excellent hand by the parent's behavior's but it is clear that more research needs in this field is required.

Yet in many of cultures, the right - handed is strongly encouraged. In Maswai culture, about 90% of teachers and parents say that if the children tend to have the left-handedness, they should be enforced to change it to the right-handedness. They believed that the left-handed have the lower strength and skills. Up to these years in Taiwan, the left-handed people are strongly encouraged to change to right - handedness or at least write with right hand. Really, the world right/left in Taiwanese culture means actual/back [23].

## Sociology theory of hand of excellency

The evolution assumption through the philosophy of the natural selection, is a defendant for enhancing of the features of the dominant behavior and non-dominant minority (unless the minor features connect to the desirables). So, all human society seek to keep the minority of the left-handed. The reason of this work:

- A. Any weakness that exist with the features of minority (for example a probable increase of given sickness) is offset with the benefits obtained from the left-handed that is heavier and more important.
- B. There is a moderate amount of abundance allocated to the expenditure of left-handed and right-handed based on the relative abundance from every type in the society;
- C. Hand of Excellency is slovenly associated to some to the statements of expenditures - benefits in the heritage features [24].

This theory is delivered in [24]. The researchers by collecting of the ethnography data with the discussions in success of left - handed in the given sports, discussed to prove that the left-handed people in combat have the competitive advantage. It seems that there is a correlation between the proportion of left-handed and the level of asperity in given society (the proportion of murder and homicide being considered as a criterion). After it, it is said that the minority of left-handed has historically determining role in the change of human societies [24].

## Advantages of hand of excellency in sport

The advantage for players in one sport like tennis, swords man ship or jujitsu is that in a population about 10% of left-handed and 90% of right-handed, 90% of playing of left handed is against the right-handed and this asymmetry is a good practice for them. 90% of playing of right-handed have been done with other their right-handed and when they in a match face with a left-handed, practiced lower. When one left-handed faces with another left-handed, they are similarly at one level of practice, as if one right-handed face with right-handed. This subject explains that



why in an unropes manner many left-handed are found in sport that in direct one activity is dominant and absolute. In other sports like golf, this advantage does not exist because the one activity is indirect, and the excellent hand of one player doesn't have any effect on other cases. It is difficult to find a golf stick for left hand. In cricket, having a Bowler with left-handed for right-handed batsmen is more challenging, because the angle of ball is very different from the player that have similar excellent hand [16].

Tools of measuring of excellent hand one of the methods of measuring of excellent hand is using of Dutch handedness Questionnaire. This questionnaire of self-recognizing of excellent hand, contains of 16 Questionnaire of self-recognizing of excellent hand, contains of 16 questions about excellent hand. For every activity in questionnaire, the people determine to use the left hand or right hand and/or both of hands (three spectra). Every question from 0 to 2 are scoring so that the score to Zero is for the answer "left hand", score 2 for "right hand" and score 1 for answer a both of hands". Therefore, all scores can be from 0 to 32. (At most for left - handed and right - handed) [25]. Also, waterloo handedness questionnaire can be used for identifying of the excellent hand that includes of 32 questions and requires the respondent to reply for every question livery activity) that from which hand he uses, and if it necessary assimilates every activity to select correctly the related hand for each one of activities. This questionnaire has five spectra (always right, usually right, equally, usually left, always left).

Many of people are neither excellent left-handed and nor excellent right-handed. So, there are different grades of excellent hand. Some people for a work that needs skill, use a special hand and for other works use another hand. Some of humans use also for different works the similar hand. Another one, is Briggs and [26] excellent hand questionnaire that is more complete than the other questionnaire about this field includes of the following components which includes of 12 questions that briefly as follows:

- A. Legible writing
- B. Throwing ball to target
- C. Racket catching
- D. Sweeping of room
- E. Drawing of matches on the Mercury of match
- F. Transferring of sand with dibble
- G. Cutting of paper and card
- H. Brushing of the teeth
- I. Moving the cards while playing
- J. Hammering on the spike
- K. Turning of the cap of jam glass
- L. Catching string while stringing the needle

For every question should base on the following spectrum, they specify that for every activity from which hand they use:

Always right hand, usually right hand, both hands, usually left-hand, always left-hand.

After finishing of answering for every questionnaire proportional with the reply that is given is scored as follows:

- A. +1= usually right hand
- B. +2= always right hand
- C. -2= always left hand
- D. -1= usually left hand

At the end of questionnaire of excellent hand, 4 other questions, other than the main questions ore asked that the people due to some reasons like ulcer, damage and ... cannot use their excellent hand, state it [26]. Finally, the scores are summed up and the result is as follows:

- A. Score -24 to -9=(Left-hand)
- B. Score -8 to +8=Mixed hand of Excellency
- C. Score +9 to +24=Right hand

## Discussion & Conclusion

At the first stage, many humans think that are right-handed or left-handed but by doing of the test of identifying of excellent hand in more probably reach to a result other than it, because most humans have mix hand of excellency. As it is stated many factors may be affective on the excellent hand: genetic factor, social factors, and cultural factors and in this article, at first the concepts of hand of Excellency, then the theories of hand of Excellency were presented.

The new theories of hand exceling view in the different manner the hand of Excellency. The new view is that the hand of Excellency is not only the simple Excellency of one hand because both hands work with each other in many skillful and precise works. excellent hand in daily life, sport, work and... can be more important because based on the proceeded researches, many of objects are built for right - handed that this matter may be stressful while using of that object for left - handed. Yet in many of cultures, strongly, being right handed is encouraged. In sport, skill learning is independently influenced by the best. As the response time represents the speed of learning [5].

Athletes must perform sports athletes, competitions, and athletics. Instructors need to design and organize the training conditions so that they can be more successful in future implementation due to these performance requirements. In sports such as basketball and soccer, athletes are required to perform complex skills not only with superior hands, but also with non-top performances. For a basketball player to be able to protect his ball against the opponent, he must be able to dribble with both hands, as well as the ball released from the ring with a superior or non-superior hand, depending on the ball back of the ring and the player's position, Rebound.

These situations and the like suggest that the use of both sides of the body is an indispensable necessity for successful

performance in competitive environments. While most coaches and athletes accept this principle, the acquisition of skill is bilaterally overlooked in today's practice programs. In the context of the usefulness of the various methods of learning sequencing and the direction of lateral transfer, there are ambiguities and challenges that further research findings can be useful for optimizing motor learning processes, improving exercise practices, and designing training for sports skills..

## References

1. Emami T (2015) The effect of practice order with dominant and non-dominant hand on acquisition, retention and transfer of basketball dribbling skill. *Journal of Motor Behavior and Exercise Psychology* 14: 1005-1014.
2. Bagherzadeh F, Sheikh M, Shahbazi M, Tahmasbi BS (1997) Learning and controlling: Theories and concepts. *Bamdad book* (1<sup>st</sup> edn), Iran, pp.152-157.
3. Stöckel T, Weigelt M (2011) Brain lateralization and motor learning: Selective effects of dominant and non-dominant hand practice on the early acquisition of throwing skills. *Laterality* 17(1): 18-37.
4. Stöckel T, Wang J (2011) Transfer of short-term motor learning across the lower limbs as a function of task conception and practice order. *Brain Cogn* 77: 271-279.
5. Farnaghi Z, Badami R, Nezakatal HM (2015) The effect of handedness and practice type (Explicit vs. Implicit) on sequential reaction accuracy and time. *Journal of Development and Motor Learning* 7(4): 529-548.
6. Grouios G, Tsorbatzoudis H, Alexandris K, Barkoukis V (2000) Do left-handed competitors have an innate superiority in sports? *Percept Mot Skills* 90(3 Pt 2): 1273-1282.
7. Guiard Y (1987) Asymmetric division of labor in human skilled bimanual action: The kinematic chain as a model. *J Mot Behav* 19(4): 486-517.
8. Haywood K, Getchell N (2014) *Life span motor development* (6<sup>th</sup> edn), Human kinetics, Australia.
9. Ghaemi J (1991) *Family and children's issues*. Parents and Educators Publications.
10. Gholampour H, Doostan M (2017) The effect of dominant hand and bimanual coordination task difficulty on the brainwave of cortical areas in right and left-handed persons. *Neuropsychology* 2(7): 47-62.
11. Fayyaz A (1991) *Left-hand notes*. Faculty of Rehabilitation, Canada.
12. Gursoy R (2008) Effects of left or right-hand preference on the success of boxers in Turkey. *British Journal of Sports Medicine* 43(2):142-144.
13. Chittibabu B (2014) Comparison of repeated sprint ability and fatigue index among male handball players with respect to different playing position. *International Journal of Physical Education Fitness and Sports* 3(1): 71-75.
14. Eckner JT, Kutcher JS, Richardson JK (2010) Pilot evaluation of a novel clinical test of reaction time in national collegiate athletic association division in football players. *J Athl Train* 45(4): 327-332.
15. Kabbash P, Buxton W, Sellen A (1994) Two-handed input in a compound task. In *CHI 94*: 417-423.
16. Santrock JW (2008) *Motor, sensory, and perceptual development*. In: Mike Ryan (Ed.), *A topical approach to life-span development*. Boston MA, McGraw-Hill, New York, USA, pp. 172-205.
17. Johnson KC, Daviss BA (2005) Outcomes of planned home births with certified professional midwives: Large prospective study in North America. *BMJ* 330(7505): 1416.
18. Sakala C, Corry M (2008) *Evidence-based maternity care: What it is and what it can achieve*. Milbank memorial fund, New York, USA.
19. Enkin M (2000) *A guide to effective care in pregnancy and childbirth*. Oxford University Press, UK.
20. Salvesen KA, Vatten LJ, Eik NSH, Hugdahl K, Bakketeig LS (1993) Routine ultrasonography in utero and subsequent handedness and neurological development. *BMJ* 307(6897): 159-164.
21. Kieler H, Axelsson O, Haglund B, Nilsson S, Salvesen KÅ (1998) Routine ultrasound screening in pregnancy and the children's subsequent handedness. *Early Hum Dev* 50(2): 233-245.
22. Shaw D, McManus IC (1993) The handedness of Kerrs and Carrs. *Br Journal of Psychology* 84: 545-551.
23. Buxton W, Myers B (1986) A study in two-handed input. In *ACM SIGCHI Bulletin* 17(4): 321-326.
24. Faurie R (2004)
25. Van Strain JW (2002) *The dutch handedness questionnaire*. Erasmus University Rotterdam, Rotterdam, Netherland.
26. Briggs GG, Nebes RD (1975) Patterns of hand preference in a student population. *Cortex* 11(3): 230-238.

For possible submissions Click below:

Submit Article