



HISTORY OF MEDICINE / ИСТОРИЈА МЕДИЦИНЕ

Historical aspects of left-handedness

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SUMMARY

Lateralization is one of the central questions in neurology, neuropsychology, and other related scientific disciplines. There has been very little change in the proportion of left-handers since the Upper Paleolithic Age about 10,000 years ago and it is estimated to be around 10%. As the history of human thinking has developed from superstition to science, the explanation of left-handedness transformed from “devil’s work” to neurological specificity. This paper presents this very interesting historical change by analyzing the data on left-handedness and the attitudes towards it in human societies from prehistory to today. Even in a relatively open-minded society, parents and teachers may encourage a left-handed child to switch to right-handedness to make their lives easier in a largely right-handed world. On the other hand, left-handedness is increasingly seen as a special gift, and left-handed people have started to favor themselves as more competent in relation to the right-handed people.

Keywords: laterality; handedness; history

INTRODUCTION

Hand dominance is a tendency to use one hand rather than the other for certain fine motor activities that require the use of only one hand [1]. Human hands are architecturally symmetrical, but they markedly differ in the tendency to perform various manual activities more frequently with one hand rather than the other. In the majority of people, the right hand is dominant [2].

Large intra-individual variation in hand preference makes a well-known dichotomous distinction on left and right-handed people insufficient for a clearer understanding of this phenomenon. Some people are inconsistent in hand preference, using a preferred hand for one and non-preferred hand for another manual activity. Such an inconsistency in hand preferences is usually described as “mixed-handedness.” In contrast to this, “ambiguous handedness” represents inconsistency in the use of the dominant hand of the same manual activity. Another relevant distinction is related to the degree of hand preferences. Two right-handed people may differ in the degree of preference; one always uses the preferred hand for most activities, whereas the other sometimes uses the non-preferred hand for certain activities [3].

To date, many aspects of hand dominance such as evolution, etiology, geographic variations, presence in different social communities and in time, remain unclear. Many scientists think that lateralization is one of the central questions in neurology, neuropsychology, and other related scientific disciplines [1].

As the history of human thinking has developed from superstition to science, the explanation of left-handedness transformed from

“devil’s work” to neurological specificity. The objective of this paper is to present this interesting historical change by analyzing the data on the presence of left-handedness and the attitudes towards it in human societies from prehistory to today.

PREHISTORY

Numerous studies have been carried out to answer the question when, where, and how man became right-handed [4]. According to archaeologist Nicholas Toth, as long as 1.5 million years ago, more than half of the early stone tools were chiseled with the right hand [5]. Another proof of prehistoric handedness is a 1.6-million-year-old *Homo ergaster* skeleton found in Kenya by Richard Leakey and his team; it shows some evidence of right-handedness in the length of the ulna bones and the depth with which the deltoid muscles attach to the clavicle [6].

Furthermore, *Australopithecus africanus* from 2–3 million years ago used to smash the skulls of baboons the way the right-handed people do [7]. An analysis of the shapes of various hominid tools about 500,000 years old found that most of them were made and used by right-handers. The remains of an old Neanderthal, 35,000 years old, show a 93% prevalence of right-handedness [8].

Interestingly, there has been very little change in the proportion of left-handers, which continues at around 10%, since the Upper Paleolithic Age, around 10,000 years ago [9]. An analysis of handedness in some skilled actions, from throwing a spear to needlework, by Stanley Core and Clare Porac, shows a remarkably

Received • Примљено:

May 22, 2019

Accepted • Прихваћено:

August 22, 2019

Online first: September 5, 2019

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consistent record of around 10% left-handedness going back over 5,000 years. This is amazingly similar to the proportion of left-handed people in the human population today [10, 11].

ANCIENT HISTORY

Right-handedness was also dominant in ancient civilizations, from Greece and Rome to China, Egypt, and Mesopotamia. It was a privilege to be on someone's right-hand side. In almost all of these cultures, the right hand was used for ceremonies and for eating. The inhabitants of Mesopotamia considered left-handedness a punishment from the gods. Strongly anti-left ancient Egyptians often depicted their enemies as left-handed, while they were the righteous dextral [9].

Each of the 10 first principles of the early Greek mathematician and philosopher Pythagoras comprised pairs of opposites, and it comes as no surprise that right is listed on the same side as light, good, male, straight, etc., while left is listed alongside darkness, evil, female, crooked, etc. [12]. Similarly, the early Greek philosopher Anaxagoras thought that only the sperm from the right testicle produced boys [13].

The reason for ancient Greeks' consideration of left-handedness as evil work and a bad sign may be found in the myth of the castration of Uranus. Cyclops and Titans were the sons of Gaia (Mother Earth) and Uranus. After their birth, Uranus closed Cyclops to the underworld (Tartar). Eager for revenge, Gaia invited Titans to punish their father. While Uranus was making love with Gaia, the youngest Titan, named Cronus, grabbed Uranus's genitals with the left hand and cut them off by a stone sickle [14].

One interesting investigation examines the data on scrotal asymmetry in some detail, and puts them in the context of Greek theories of functional differences between the right side and the left side [15]. Famous is the ancient debate between Plato and his student Aristotle about left-handedness. Plato, a right-hander, said that the dominance of hand skills was learned, while left-handed Aristotle in his book *Metaphysics* claimed that people were naturally right-handed or left-handed [16].

Ancient Romans were also very pro-right-handedness. For example, they claimed that wearing a wedding ring on the third finger of the left hand would fend off evil that is in the left-hand. Shaking right hands in greeting dates back to ancient Rome as a proof of the absence of hidden weapons. It seems that Julius Caesar encouraged this ritual being permanently afraid of assassination [17].

Surprisingly, Yin in ancient China is associated with female sex, darkness, and right-handedness, while Yang is related to masculinity and light, but also to left side. In spite of that, modern China advocates the domination of right-handedness [12].

Ancient Incas believed that left-handed individuals had a magic power of healing people. Eskimos also believed left-handed individuals to be wizards [13].

RECENT HISTORY

During the Middle Ages, left-handedness was considered "sinful." Under the strong influence of the Catholic Church, left-handedness was connected with the "devil," "weakness," "feminine," "unhealthy," "filthy," with something that had to be forced to turn to the "good-right" side [18].

Left-handed people were accused of friendship with the devil. During the Inquisition, left-handedness was sufficient to sentence a woman to death as a witch. Many innocent left-handed people were executed in this way [17]. The right arm was blessed, while the left-handed served the devil. Making a sign of the cross with left hand was a heresy that caused hell. An analysis concerning handedness in the Bible found about 100 positive references to right and the right arm and about 25 negative references to left and the left hand. A similar point of view can be found in the Qur'an. In both Islam and Hinduism, the right hand is used exclusively during solemn ceremonies [10].

In contrast, there are some minor religions, like Tantric Buddhism for example, in which left-handedness was considered positive, and a symbol of wisdom [12, 17].

In addition to religion, occult sciences, such as Tarot cards, engage in prejudices on left-handedness. Two of the most famous tarot cards, Lady Justice and the Devil, symbolically depict such prejudices. Lady Justice is holding a sword in her right hand, while the devil uses his left hand [12, 18].

During the Renaissance, the interest for nature and human beings flourished. It is reported that Michelangelo and Leonardo da Vinci used both hands in their works [19]. One study suggests that the handedness of Leonardo da Vinci is controversial. There is no doubt that many of his well-known drawings were drawn with the left hand, and there are some indications that he may have become left-handed as the result of an injury to his right hand in early adulthood [20]. The handedness of Michelangelo Buonarroti, is also controversial. Although there is no doubt that almost all of his drawings were drawn with the right hand, an unfairly unknown autobiography of Raffaello da Montelupo stated that Michelangelo, a natural lefty, trained himself from a young age to become right-handed. This biography also underlined that Michelangelo restricted the use of his left hand only to actions requiring force, such as hammering, carving, and chiseling marble [21].

Unfortunately, in the 18th and 19th centuries, the discrimination against left-handed people was strong and institutionalized. It included such practices as tying a child's left hand behind his chair or corporal punishment for anyone caught writing with the left hand. During the industrial revolution, left-handedness was particularly unfavorable, as machines and tools were designed for the right-handed people [17].

In the 19th century, Cesare Lombroso, an Italian criminologist and physician, connected left-handedness with savagery and crime. Fortunately, his ideas on left-handedness and human behaviour were later discarded [22].

Very important for understanding handedness was a famous discovery of French scientist Broca (Pierre Paul

Broca) about the asymmetry of brain hemispheres, in 1860. After Broca's investigations, the interest in studying laterality declined for a while, and was renewed exactly one century later, in 1960. By studying the patients who underwent an operation of severing a commissure that connects the left and the right hemisphere of the brain in order to control intractable epilepsy, it was concluded that the left hemisphere is specialized for language, and the right one for emotional and nonverbal functions. This research brought Roger W. Sperry a Nobel Prize in Physiology or Medicine in 1981 [16].

Despite these epochal discoveries, the practice of discrimination against left-handed people continued in the 20th century. Even in scientific circles, there were opinions that handedness was a result of a certain pathology. For example, in the research by Gordon [23], an increased number of left-handed people was found among the mentally retarded.

In the mid-20th century, Abram Blau, an American psychoanalyst and child psychiatrist, was still suggesting that left-handedness was merely due to perversity and the result of emotional negativism in childhood. Blau claimed that left-handed people became stubborn, rebellious, rigid, and for some reason obsessed with cleanliness in adulthood. An influential British educational psychologist Cyril Burt supported Blau's ideas, describing left-handed people as "stubborn and willful," as well as "awkward" and "clumsy" [9].

It is interesting to mention an article in the daily newspaper *Pravda* (Kingdom of Serbs, Croats, and Slovenes) of April 6, 1937 about a "Left-handed Club" in New York founded by a Methodist priest. He was also left-handed and he shared blessings using his left hand. In this club, he gave lectures where he claimed that left-handedness was a great gift of nature and that left-handed people were more able and talented than right-handed people. He supported this attitude by the fact that many great people were left-handed. The number of members of this club was unusually large [24].

North America is liberal towards left-handedness, as evidenced by a higher percentage of left-handed people compared to the rest of the world, because socio-cultural pressure was less frequent. Even in 1933, in the daily newspaper *Pravda* in the "Small Medical Curiosities," there was a short article titled "A Disappearing Left-handedness." It stated that there was a large number of children who were left-handed in childhood, but later became "normal" and regularly used the right hand. "According to the latest statistics," the paper stated, "in Europe there are about 10% of left-handed children, and only 2% of left-handed adults" [25]. This difference could be explained by a socio-cultural pressure against left-handed people of this age. Such a drastic reduction in the presence of left-handed people some researchers today explain by socio-cultural pressure against left-handed people, while others advocate the hypothesis of a shortened lifespan of left-handed people in a right-handed-designed world [26]. In the Conway's handbook published in 1935, *The Prevention and Correction of Left-Handedness in Children*, he recommended training children from infancy to overcome left-handedness, which came as a result of parental "indifference to the seriousness of the handicap," which was a "sinistral condition,"

a "disease" that needed to be recognized along the same lines as "rickets, pneumonia and colic" [27].

In the 1960s and 1970s, Catholic schools continued with psychological pressures against left-handed children, and sometimes also retained corporal punishment. Until the end of the 1970s in the countries of the Soviet Bloc as well as in former Yugoslavia, there were similar practices against left-handed people. In Albania, left-handedness was declared illegal and was punishable as a crime, while in Japan left-handedness of a woman was grounds for divorce [28].

LEFT-HANDEDNESS TODAY

Social tolerance was officially accepted for left-handed people in the 21st century, but it is not uniform worldwide. Even in a relatively open-minded and informed society of today, parents and teachers may encourage a left-handed child to switch to right-handedness to make their lives easier in a largely right-handed world. A good percentage of natural left-handed people tell of their own self-inflicted attempts to switch hands during childhood [29].

This pressure to change the dominant hand may cause huge stress during childhood and education. A vulnerable group that should be put in focus for the prevention during the school period are left-handed students in all fields, particularly those of longer and demanding study programs. Studies show that examination process and prolonged studies present an additional risk factor for stressful experiences in students, such as students of medicine [30].

At the level of social cognition in Serbia, subtle prejudice against this minority group is still present and visible. This is demonstrated by the fact that the prevalence of left-handedness is lower in Serbia than in Western Europe (5–10% vs. 11–14%) [29]. In a study conducted in Belgrade on a sample of 1,189 children aged 15–19 years, the percentage of left-handed children was 6.8%, with a significantly higher number of male left-handed people compared to female population (8.9% vs. 4.8%) [26].

Nowadays, left-handedness is considered to be a special gift, and left-handed people have started to evaluate themselves differently, even favouring themselves as more competent in relation to the right-handed people. "The last neglected minority" has begun to organize themselves on websites such as www.anythingleft-handed.co.uk. The August 13th has been declared the International Day of Left-handed People. Left-handed people are slowly becoming proud of their former "handicap." A list of left-handed individuals who have marked the human history has become very long and includes writers (Honoré de Balzac, Mark Twain, Charles Dickens, Lois Carroll, Franz Kafka, Gabriel García Márquez), musicians (Ludwig Van Beethoven, Wolfgang Amadeus Mozart, Sergei Prokofiev, Sergei Rachmaninoff, Maurice Ravel, Robert Schumann, Niccolò Paganini, Ringo Starr, George Michael, Sir Paul McCartney, Jimi Hendrix, Bob Dylan, Phil Collins), artists (Michelangelo Buonarroti, Leonardo da Vinci, Lautrec de Toulouse, Peter Paul Rubens), actors (Greta Garbo, Judy Garland, Fred Astaire, Charlie Chaplin, Marilyn Monroe,

Rock Hudson, Anthony Perkins, Pierce Brosnan, Oprah Winfrey, Julia Roberts, Sarah Jessica Parker, Demi Moore, Nicole Kidman, Kim Basinger, Sylvester Stallone), philosophers-scientists (Aristotle, Friedrich Nietzsche, Albert Einstein, Ivan Pavlov, Marie Curie, Nikola Tesla), athletes (Valentino Rossi, Diego Maradona, Goran Ivanišević, John McEnroe, Martina Navratilova, Monica Seles, Rafael Nadal), leaders (Ramses II, Tiberius, Julius Caesar, Alexander the Great, Napoleon Bonaparte) [31].

REFERENCES

1. Uzoigwe OF. The dangers of ambidexterity: the origins of handedness. *Med Hypotheses*. 2013; 81(1):94–6.
2. Bojanin S. Neuropsychology of a development age and a general education method. Belgrade: Zavod za udžbenike i nastavna sredstva; 1985. Serbian.
3. Milenković S, Paunović K. Noise sensitivity, handedness, and the occurrence of high perceived anxiety and depression in young adults. *Pers Indiv Differ*. 2015; 83:158–63.
4. Reiss M. Phylogenetic aspects of laterality. *Anthropol Anz*. 1998; 56(1):81–90.
5. Toth N. Archaeological evidence for preferential right-handedness in the Lower and Middle Pleistocene, and its possible implications. *J Hum Evol*. 1985; 14(6):607–14.
6. McManus C. Right hand, left hand: The origins of asymmetry in brains, bodies, atoms and cultures. Cambridge, MA: Weidenfeld and Nicolson, Harvard University Press; 2002.
7. Right Left Right Wrong. An Investigation of Handedness – Some Facts, Myths, Truths, Opinions and Research. History of Handedness [Internet; Accessed September 2018]. Available from: https://www.rightleftrightrightwrong.com/history_prehistory.html.
8. Llaurens V, Raymond M, Faurie C. Why are some people left-handed? An evolutionary perspective. *Philos Trans R Soc Lond B Biol Sci*. 2009; 364(1519):881–94.
9. Coren S. *Advances in Psychology*. Vol. 67. Left-Handedness: Behavioral Implications and Anomalies. North Holland: Elsevier; 1990.
10. Dragović M. Inconsistent hand preference lateralisation in schizophrenia patients. *Psihologija*. 2001; 34:225–43. (Serbian)
11. Dominguez-Ballesteros E, Arrizabalaga A. Laterality in the first Neolithic and Chalcolithic farming communities in northern Iberia. *Laterality*. 2015; 20(3):371–87.
12. Corrbalis M. 1983. Human laterality. New York London Paris San Diego San Francisco Sao Paulo Sydney Tokyo Toronto: Academic press; 1983.
13. Right Left Right Wrong. An Investigation of Handedness – Some Facts, Myths, Truths, Opinions and Research. History of Handedness – Ancient History [Internet; Accessed August 2018]. Available from: http://www.rightleftrightrightwrong.com/history_ancient.html
14. Graves R. *The Greek Myths*. London: Penguin; 1963.
15. McManus IC. Right-left and the scrotum in Greek sculpture. *Laterality*. 2004; 9(2):189–99.
16. Milenković S, Paunović K, Kocijančić D. Laterality in living beings, hand dominance, and cerebral lateralization. *Srp Arh Celok Lek*. 2016; 144(5–6):339–44.
17. Coren S. *The left-hander syndrome: the causes and consequences of left-handedness*. New York: The Free Press; 1992.
18. Milenković S, Belojević G, Kocijančić R. Social aspects of left-handedness. *Srp Arh Celok Lek*. 2010; 138(9–10):664–7.
19. Paul D. *Left-Handed Helpline*. Manchester: Dextral Books; 1994.
20. McManus IC, Drury H. The handedness of Leonardo da Vinci: a tale of the complexities of lateralization. *Brain Cogn*. 2004; 55(2):262–8.
21. Lazzeri D. The handedness of Michelangelo Buonarroti. *Clin Anat*. 2018; 31(5):645–7.
22. Kushner HL. Cesare Lombroso and the pathology of left-handedness. *Lancet*. 2011; 377(9760):118–9.
23. Gordon H. Left-handedness and mirror writing, especially among defective children. *Brain*. 1921; 43:313–68.
24. Left Handers Club. *Pravda*. 1937 April 6.
25. Little Medical Curiosities: A Disappearing Left-handedness. *Pravda*. 1933 March 26.
26. Milenković S. Investigation of health and social aspects of left handedness in high-school adolescents [dissertation]. Belgrade: Faculty of Medicine, University of Belgrade; 2008.
27. Conway JW. *The Prevention and Correction of Left-handedness in Children*. Conway JW: 1936.
28. Right Left Right Wrong. An Investigation of Handedness – Some Facts, Myths, Truths, Opinions and Research. History of Handedness – Recent History [Internet; Accessed September 2018]. Available from: http://www.rightleftrightrightwrong.com/history_recent.html.
29. Dragović M, Badcock JC, Milenković S, Gregurović M, Šram Z. Social stereotyping of left-handers in Serbia. *Laterality*. 2013; 18(6):719–29.
30. Backović DV, Maksimović M, Davidović D, Zivojinović JJ, Stevanović D. Stress and mental health among medical students. *Srp Arh Celok Lek*. 2013; 141(11–12):780–4.
31. Anything Left-Handed. Famous left-handers [Internet; Accessed August 2018]. Available from: www.anythinglefthanded.co.uk/being-lh/famous.html

ACKNOWLEDGEMENT

This work was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia (Grant Numbers 41020; 175078; 175067. 2011–2018).

Conflict of interest: None declared.

Историјски аспекти леворукости

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САЖЕТАК

Латерализација је једно од централних питања у неурологији, неуропсихологији и другим сродним научним дисциплинама. Постоје незнатне промене у пропорцији леворуких од млађег палеолитног доба пре 10.000 година и процењена је на око 10%. Како се историја људског размишљања развијала од сујеверја према науци, објашњење за леворукук променило се од „ђавољег посла“ до неуролошке специфичности. Овај рад приказује ову веома интересантну

историјску промену анализирајући податке о леворукости и ставовима према њој у људском друштву од праисторије до данас. Чак и у релативно отвореним друштвима родитељи и наставници могу охрабрити леворуку дете да се превежба на десноруку, да би им живот учинили лакшим у већински десноруком свету. С друге стране, на леворукук се све више гледа као на посебан дар, а леворуки су почели себи да дају предност и већу компетентност у односу на десноруке људе. **Кључне речи:** латерализација; доминантност руке; историја