



The History of Handedness

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It has been suggested by social historians that a minority group exists in every society that face prejudice in the language used to describe them and no sense of common identity or collective power.ⁱ It is estimated that 8% of the world's population are left-handed and yet the origins behind handedness are still not entirely clear.

Although it is common to identify handedness by the hand used for writing, many experts describe handedness as a preference or skill with many people able to use either hand for a variety of tasks. The fact that such a small but consistent percentage of the world's population are left-handed and that this figure remains stable has intrigued scientists for many years.

A breakthrough occurred in 2007 when a group of scientists from Oxford University, led by Clyde Francks, discovered a gene known as LRRTM1 which increases the likelihood of left-handedness. This gene also seems to indicate a slightly increased risk of developing certain mental illnesses although there is still much research to be done;

"There are many factors which make individuals more likely to develop schizophrenia and the vast majority of left-handers will never develop a problem. We don't yet know the precise role of this gene."ⁱⁱ

It is estimated however that genetics only contributes to 25% of the variability of handedness.ⁱⁱⁱ This can be seen in studies conducted on identical twins who although sharing identical genetic material do not always share the same handedness preference. It has also been observed that left handedness is slightly more common amongst males and is more commonly inherited through the maternal than the paternal genetic line.



Whilst researching and observing handedness is very straightforward, understanding its origins is not so simple. It has been determined that handedness is closely linked to where language function exists within the brain. Clare Porac, a professor of psychology at Pennsylvania State University explains;

"The two most widely published genetic theories of human hand preference argue that evolutionary natural selection produced a majority of individuals with speech and language control in the left hemisphere of the brain. Because the left hemisphere also controls the movements of the right hand – and notably the movements

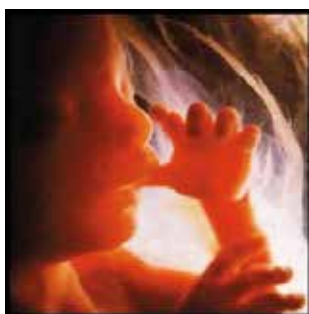
needed to produce written language – millennia of evolutionary development resulted in a population of humans that is biased genetically towards individuals with... right handed preference."^{iv}

The role of language function and handedness is also supported by studies that show that animals without complex language function, such as mice, cats, rats and dogs show an even distribution of left and right handedness (or pawedness?)^v



In addition to the role that genetics play in handedness, the development of a baby's brain in the womb seems to make a significant contribution although the reasons for this are still being discovered. Statistics suggest that older mothers, as well as those who smoke during pregnancy or experience significant stress during pregnancy have an increased likelihood of having a left-handed child. A study that focused on Apgar scores (a scale used to measure a baby's physical condition at birth) showed an increased likelihood of left-handedness amongst babies with lower scores^{vi}

Several studies have demonstrated that handedness may well be established in the womb, contradicting earlier theories that it is not established until a child is three years old. A study by scientists at Queen's University in Belfast observed the thumb-sucking habits of 75 fetuses^{vii} and discovered that 60 fetuses sucked their right thumb and 15 preferred their left thumb. When these children were revisited between the ages of 10 and 12, all 60 right thumb suckers were right-handed and two-thirds of the left thumb suckers were left handed. The other five subjects had switched to a right-handed preference.



The same research team also discovered that the ratio of left and right thumb suckers in utero, even at 15 weeks gestation, paralleled the adult ratio of handedness; namely 9 out of 10 fetuses showed a preference for their right thumb. Remarkably, even at 10 weeks gestation, the majority of fetuses observed made more waving motions with their right arms than their left. At this

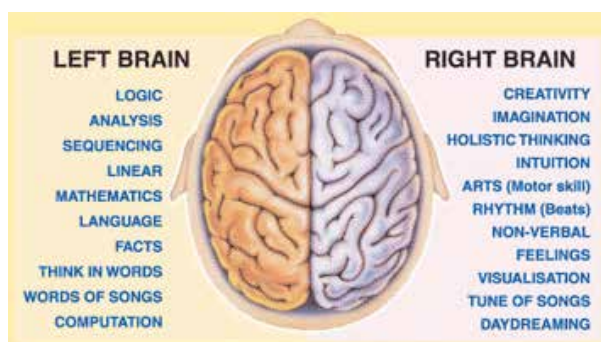
stage of gestation, it is not thought that nervous connections from the body to the brain have developed. The lead researcher on the project posits one possibility for this preference at such an early stage;

"... Professor Hepper believes the arm movements are probably the result of local reflexes involving the spinal cord. One side may be favoured over the other, because it develops slightly faster."^{viii}

New parents keen to estimate the handedness of their infant should observe the direction in which they rest their head when lying on their tummies. Research shows that babies who choose to face to the right are usually right-handed whereas left-handed babies will choose to face towards the left or to not show a preference.^{ix}

Another possible explanation for left-handedness, favoured by some scientists in the past was Vanishing Twin Syndrome. It has been estimated that as many as 1 in 8 pregnancies begins as multi- gestational but one embryo fails to survive during the early weeks of the first trimester and is reabsorbed into the mother or other embryo. The contention is that this anomaly causes the surviving twin to be left-handed as a genetic 'mirror image' of the deceased embryo.^x Whilst there is research supporting the high frequency of multi-gestational pregnancies, this explanation of the origins of left-handedness is less commonly accepted within the scientific community.

Unique to humans, although apparent to a lesser degree in some primates, is the asymmetrical brain which also holds vital clues in the search for the origins of handedness. Brain asymmetry means that the human brain is divided into two hemispheres which have different functions and enable humans to work on two different



tasks at the same time. Historically, it was understood that the left hemisphere controlled the right side of the body and the right hemisphere, the left side of the body. Scientists therefore concluded that right handed people were 'left-brained' and

therefore more likely to share certain characteristics and aptitudes including scientific and mathematical skills and a greater degree of logic and language skills. 'Right-brained' people (left-handers) on the other hand, tended towards the more creative and emotional skills.^{xi}

Extensive research in the last decade has shown that the left hemisphere is dominant for approximately 70% of left handers as well as most right handers.^{xii} The remaining 30% of left handers seem to be divided equally between right hemisphere dominant or having a distributed pattern between both hemispheres. It is interesting to note that the right hemisphere dominant left-handers, who make up 1.2% of the world's population, tend to excel in particular professions;

"Certain occupations are associated with right-brained people, including politics, acting and athletics. Many occupations that require creative thinking, perceptiveness and spontaneity are in the field of the right-brain dominant."^{xiii}

This is fascinating when considering that with the exception of George W Bush, the US Presidency has been fulfilled by left handers for the last 32 years. Meanwhile, on this side of the Atlantic, Queen Elizabeth, Prince Charles and Prince William are all left-handed.

The Endurance of the Left-Handed Minority

Whatever theories combine to explain the origins of left-handedness; the question of its stable longevity in the face of such fierce evolutionary competition remains. There appears to be a consistent proportion of left handed people throughout the world, regardless of culture or geographical location.^{xiv} This is evident even in pre-literate communities in the most remote parts of the world.^{xv}

There is some evidence to suggest that brain asymmetry has existed in humans for approximately 1 million years.^{xvi} This in turn suggests that humans have had a dominant hand or side for a similar time. The earliest evidence of handedness can be seen on dental remains of Neanderthal man from 400,000 years ago. At this time, a sharpened tool was held in one hand to cut meat that was held between his teeth and his other hand. If the tool slipped, it left marks on his teeth which can be used to identify which hand held the tool.^{xvii} As tools become more sophisticated through the Stone Age, a right-handed preference began to emerge and one theory suggests that this inclination grew out of sun worship. For the Northern hemisphere, it is necessary to face south and travel from left towards the right to follow the sun until it sets in the west. This could have led to a belief that the right side and moving to the right was more important.

Another more practical explanation was the use of spears and shields in combat. Whilst it's unlikely that the first human warriors had an understanding of human anatomy and the location of the heart; they would have observed that humans who were speared or attacked on their left side suffered more serious consequences and would therefore try to protect this area. By holding a shield with the left hand, the right hand would be responsible for the more precise task of spearing or stabbing an opponent. Those who developed a dominant right hand would have fared better in combat and thus in evolutionary terms, would have been more likely to pass on this disposition to their descendants.



By the Upper Palaeolithic Era (30,000-10,000 BC), evidence from European cave paintings suggests that the proportion of left-handers in society was similar to the figure for today. Charlotte Faurie and Michel Raymond from the University of Montpellier analysed

negative hand impressions made by holding a reed through which pigments would have been blown to form the image. By counting the number of prints of right hands, and by verifying the results by recreating the cave painting scenario with contemporary volunteers, the percentage of left and right-handers was determined.^{xviii}

The question remains however that if being left-handed was likely to result in an earlier death through accident or vulnerability in combat, why have levels of left-handedness remained consistent over the last 30,000 years? Two mathematicians from Northwestern University in Illinois believe that the enduring consistency of left-handedness is the result of a careful balance between **competition** and **co-operation** in society.^{xix} Daniel Abrams and Mark Panaggio assert that;

“When left-handers are scarce, they have an advantage in physical confrontations owing to their greater experience against right-handers and the right-handers’ lack of experience against them. As their numbers grow, that advantage weakens.”^{xx}

This suggests that a small number of left-handers in each community would thrive. Research from The University of Utah supports the idea that those who are competent in combat are more likely to find agreeable mates with which to continue the passage of left-handedness in future generations;

““From the perspective of sexual selection theory, women are attracted to powerful males..... because powerful males can protect them and their children from other males.”^{xxi}

In addition to this competitive element, Abrams and Panaggio also contend that in an exclusively co-operative society, it is more likely that that all members of the community would tend towards same handedness for the purposes of tool sharing and also because not conforming could render an individual excluded from groups activities that relied on same handedness. They suggest that this is still the case today;

“The modern presence of a higher accidental death rate for left-handers supports the idea that conformity to the right-handed majority remains advantageous in human society”^{xxii}

The Abrams – Panaggio model suggests a delicate balance in human evolution between excessive cooperation, which would lead to total same-handedness and excessive competition, which would lead to equal left and right handedness.

Just as left-handedness seems to feature consistently throughout the world, so too



does the bias against left hand dominance. There seems to be a tangible expectation and understanding in religious, cultural and linguistic settings that the 'right' side is 'right' and that all things 'left' are somehow inhibited or even suspicious. Indeed, the word 'sinister' come from the Latin word for 'left'.

Bias against the Left in Religion

In Judaism, Christianity and Islam the left is identified with evil or uncleanness. Judaism which is the oldest of these faiths shows this in the Talmud, where Samael, the Chief of Satans, sits at the left-hand side of God whereas the angel Michael sits to his right. Indeed the Prince of Demons' name is associated with the Hebrew word for 'left'. According to the medieval Jewish philosopher, Maimonides, being left handed was one of 100 'blemishes' that prevented a man from becoming a Jewish priest.^{xxiii} Within Islam, the influence of Middle Eastern personal hygiene customs associated with the left hand has led to the belief that it is 'unclean'.

This negative association was further perpetuated in Christianity where the right hand is used for making the sign of the cross and the giving of blessings. Traditionally a left-handed blessing is attributed to the Devil who is often portrayed as left-handed in works of art. Witchcraft texts from medieval Europe suggest that a witch's left hand could be used to place a curse on a person simply by placing it on another person. Joan of Arc is often portrayed as a left-hander but there is little evidence to confirm this; it is likely that this belief was perpetuated by the French authorities to establish her reputation as a heretic and a witch.

Within the Bible, there are more than 100 references to the right-hand and only 25 references to the left-hand, all of which are negative. The most well-known of these texts is the Parable of the Sheep and Goats (found in Matthew's Gospel, Chapter 25). The text makes it very clear that those who have served God and others are sent to the right, to heaven and those who have failed to do this are sent to the left where the fiery depths await them.



Bias against the Left in Language and Culture

It seems that it is not just within religion, that the left-handed have suffered persecution. The language and customs associated with the left have undesirable connotations in all continents of the world. From the traditional belief from the Meru people

of Kenya that their holy man's left hand was so evil it must remain hidden,^{xxiv} to the Eskimo view that every left-handed person is a potential sorcerer^{xxv} ; it seems prejudice against the left-handed population is literally woven into the world's languages:

- From Africa - In Morocco, left-handers are referred to as s'ga meaning devil or cursed person.
- From Asia - In China, the left is referred to as zuo, meaning hindering
- From South America – In Venezuela, left-handers are referred to as mochola mocha meaning maimed-handed.
- From North America – left-handers are referred to as 'goofy' or 'south-paws'
- From Australia - left-handers are sometimes referred to as Mollie Dookers meaning having fists like a girl.
- From Europe – The Latin for 'left' is sinister, as opposed to dexter for the right hand side.

On the Other Hand....

Whilst the evolutionary and cultural challenges faced by the left-handed minority cannot be disputed, there are also advantages to those who are left-hand dominant. In addition to the benefits in combat, there are also many advantages for left-handers in a range of different sports. These include tennis, where left-handed Rafael Nadal is currently ranked two in the world and baseball where a left-handed hitter is already closer to first base than his right-handed team mates as well as often confusing the pitcher with his batting technique. Abrams and Panaggio estimate that more than 50% of the top baseball players are left-handers.^{xxvi}



Amongst some of the intellectually elite, left-handers seem to outperform the right-handed counterpart making up 20% of the members of Mensa (more than twice the expected percentage in line with the general population) and many cite that there are also a disproportionately high percentage of left-handers amongst the teaching fraternity at MIT.^{xxvii}

The myth surrounding a shorter life expectancy for left-handers has been debunked and in schools, far more support and specialist equipment is available for left-handed children in the classroom today. Many research projects would identify that left-handers are not just experiencing greater equality but that they demonstrate academic advantages in certain fields. One report from the Australian National University found that left-handers tend to make faster connections

between the two hemispheres of the brain which can result in quicker thinking in certain tasks.^{xxviii} Left-handers are also believed to be better at divergent thinking, an important aspect of creativity which focuses on developing new ideas from existing knowledge – what could be more important in an economic downturn, than left-handed David Cameron or Barack Obama being able to apply divergent thinking to the situation?

ⁱ S Coren, 1992, The Left Hander Syndrome: The Causes and Consequences of Left-Handedness cited at <http://facts.randomhistory.com/facts-about-left-handedness.html>

ⁱⁱ Dr C Francks quoted at <http://news.bbc.co.uk/1/hi/6923577.stm>

ⁱⁱⁱ Research published in Neuropsychologia Journal in 2009 located at <http://www.sciencedirect.com/science/article/pii/S0028393209000177>. This study is cited by S Wang in The Health Risks of Being Left-Handed published in the Wall Street Journal, 2011, located at <http://online.wsj.com/article/SB10001424052970204083204577080562692452538.html>

^{iv} Prof C Porac, 2004, What causes some people to be left handed and why are fewer people left handed than right handed? Published in Scientific American cited at <http://www.scientificamerican.com/article.cfm?id=what-causes-some-people-t>

^v I McManus, The Inheritance of Left-handedness, 1991 located at <http://zoe.bme.gatech.edu/~bv20/bmed2400/Bank/InheritanceOfHandedness.pdf>

^{vi} S Coren, 1992, The Left Hander Syndrome: The Causes and Consequences of Left-Handedness cited at <http://facts.randomhistory.com/facts-about-left-handedness.html>

^{vii} Study published in 2004 in New Scientist magazine, cited at <http://news.bbc.co.uk/1/hi/health/3912943.stm>

^{viii} Prof P Heppler's findings are published in the study cited in endnote vi. They are described in the BBC news article cited at <http://news.bbc.co.uk/1/hi/health/3912943.stm>

^{ix} See endnote vi

^x Explanation of Vanishing Twin Syndrome is found at http://ic.steadyhealth.com/vanishing_twin_syndrome.html

^{xi} Summary taken from <http://www.lefthandersday.com/tour2.html>

^{xii} Summary taken from S Wang, The Health Risks of Being Left Handed published in the Wall Street Journal, 2011 located at <http://online.wsj.com/article/SB10001424052970204083204577080562692452538.html>

^{xiii} E E Smith, Are you left or right brain dominant? Published in Psychology Today, October 2012, located at <http://www.psychologytoday.com/blog/not-born-yesterday/201210/are-you-left-or-right-brain-dominant>

^{xiv} The only exception would be those cultures who still force left-handed children to write with their right hand.

^{xv} I McManus, The Inheritance of Left-handedness, 1991 located at <http://zoe.bme.gatech.edu/~bv20/bmed2400/Bank/InheritanceOfHandedness.pdf>

^{xvi} I McManus, The Inheritance of Left-handedness, 1991 located at <http://zoe.bme.gatech.edu/~bv20/bmed2400/Bank/InheritanceOfHandedness.pdf>

^{xvii} <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1809976/pdf/15101415.pdf>

- ^{xviii} C Faurie & M Raymond, Handedness frequency over more than ten thousand years, 2004, located at <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1809976/>
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- ^{xx} See previous endnote
- ^{xxi} D Carrier, quoted at <http://io9.com/5802921/did-early-humans-start-standing-upright-because-it-was-easier-to-beat-each-other-up>
- ^{xxii} See endnote xviii
- ^{xxiii} See endnote vi
- ^{xxiv} Cited at <http://www.anythinglefthanded.co.uk/lh-info/myths.html#sthash.dF9jVh3e.dpbs>
- ^{xxv} Cited at <http://facts.randomhistory.com/facts-about-left-handedness.html>
- ^{xxvi} Research by Abrams and Panaggio cited in article Study Reveals Why Lefties are Rare located at <http://www.livescience.com/19968-study-reveals-lefties-rare.html>
- Original research document source can be found with endnote xviii.
- ^{xxvii} Cited at http://www.brainbasedbusiness.com/2007/11/left_handers_brains_are_less_p.html
- ^{xxviii} Research reported on BBC News website located at <http://news.bbc.co.uk/1/hi/health/6212972.stm>

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