

# What We Know and Don't Know about Handedness

By Ann St. Clair Lesman



Ann St. Clair Lesman

Ann St. Clair Lesman did her undergraduate work in foreign languages at Rollins College, has two Master's degrees, one from Duke and one from the University of Maryland, and a Ph.D. from the University of Maryland. Her doctoral dissertation is in the field of diachronic linguistics. She is currently Professor Emerita, Department of World Languages and Cultures of Shenandoah University.

She was President of the Winchester chapter, 2004-2005. Her paper "Dysnomia—It's on the Tip of my Tongue" was the second to win the President's Best Paper award. Two papers, "Semantics and the Remarkable Human Brain: Why Computers Don't Translate Well" and "How Children Learn Language—and Why You Can't Learn the Same Way," were published in *The Torch*, the former winning the Silver Quill Award. Last year she was presented with the Silver Torch award for service to Torch.

Ann, who herself is left-handed, became interested in the topic of handedness while studying language processing; there is an obvious but still not fully understood relationship between handedness and which hemisphere of the brain an individual uses to process language.

Her paper was presented to the Winchester Torch Club on February 3, 2016.

What do Gerald Ford, Ronald Reagan, George H.W. Bush, Bill Clinton, and Barack Obama have in common? They were or are left-handed.

The non-right-handed comprise approximately 30 million people in the US, but most people are right-handed, and human beings have been mostly right-handed since earliest times, as we know from archeological records (tools, cave paintings of hunters). *Homo sapiens* is a predominantly right-handed creature, and has been so down the centuries and across cultures. Modern studies of handedness in different cultures reveal some differences by racial and geographic group, but the average is over 91% right-handed.

*Homo sapiens*  
is a predominantly  
right-handed  
creature, and  
has been so  
down the  
centuries and  
across cultures.

Let's consider the consequences and possible causes of non-right-handedness (NRH), which includes left-handers, people with mixed dominance, and those who are ambidextrous. There is perhaps no other behavioral difference between people that is so immediately obvious

and so fundamental yet so poorly understood.

\* \* \*

Humans are *anatomically* asymmetrical with regard to the location of many internal organs. Handedness is *behavioral* asymmetry, and this dominance also includes the foot, eye, and ear. There is a strong correlation between the dominant hand and the dominant foot. There are also correlations, progressively less strong, with the eye and the ear.

Strongly left-handed people, those who, if possible, use their left hand for everything, seem to be about 5% of the population, but the percentage of left-handed people in the population depends on the definition. Inconsistencies in research data from different studies probably stem from this variation in criteria for NRH, but another complication is that people do not necessarily report their own handedness accurately, tending to report the hand they write with. D. C. Rife, who was one of the early researchers in the area, developed a handedness checklist in 1940 in which he asked subjects which hand they used for various activities like throwing a ball. Rife's questionnaire is still in use, but in modernized versions. (If you asked a girl today which hand she uses to shoot marbles, she might not even understand the question.) Stanley Coren, who has done an enormous body of work on handedness, has a questionnaire that asks people not only about writing and eating, but also about which hand they use to comb their hair, brush their teeth, or strike a match.

Many people casually use the word “ambidextrous” for people who have mixed hand preference, but technically, the term refers to people who use either hand equally skillfully, in free variation, to do any task: to write, to draw, to swing a racquet, to use a hammer. The number of people who are truly ambidextrous is infinitesimally small. The term “mixed dominance” is the correct descriptor for people who use one hand for certain tasks and the other hand for other tasks. This group is much larger, and may be anywhere from 2% to 5% of the population.

\* \* \*

Neuroscientist W.D. Hopkins suggests that handedness might be a by-product of brain lateralization, which became exaggerated as primates evolved. As the primate brain grew bigger, the connectivity between its right and left halves became weaker and the cerebral hemispheres divided up tasks to be processed mostly in one half of the brain or the other. At the same time, Hopkins argues, hand preference became more pronounced. “As the brain got larger and larger . . . there could have been some kind of qualitative change, where you had some emergence of duality of function in the brain,” Hopkins says. “And that is what would have resulted in the emergence of something like handedness” (qtd in Grant).

In early work on brain lateralization and the functions of each hemisphere, neuroscientists learned that language is usually controlled by the left side of the brain. Subsequently it appeared that for some left-handers, language is governed by the right side of the brain. Therefore it was assumed for a while that right-handers used the left side of the brain for language and the situation was reversed for left-handers. (This prompted the joke that only left-handers are in their right minds.)

However, further studies revealed that over half of non-right-handers

also process language on the left side. Only about 20% percent of left-handers use the right hemisphere exclusively for language and speech, while some 10% are bilateral, having language in both hemispheres. To further muddy the waters, 3% of right-handers have right-hemisphere language dominance. The figures vary from study to study, but are not widely divergent.

Only about  
20% of  
left-handers  
use the right  
hemisphere  
exclusively for  
language and  
speech, while  
some 10%  
are bilateral,  
having language  
in both  
hemispheres.

The right side of the brain, which presumably was dominant in left-handers, is associated with creativity, and a lot of pop psychology (for instance, the popular work *Drawing on the Right Side of the Brain* by Betty Edwards) touted releasing the power of the right brain. Soon, though, the oversimplified split-brain model that put creativity only in the right brain and logic only in the left brain was challenged by many neuroscientists and fell out of favor with academia, although there was a lot of solid research in brain specialization behind the left brain/right brain functions.

Non-right-handedness correlates strongly with homosexuality, strengthening the argument that sexual prefer-

ence is not a “choice” but is part of the physical makeup of an individual.

\* \* \*

The scientific community is still divided on whether handedness is inherited and innate or is the result of environmental forces, the old “nature vs. nurture debate.” We are going to look at evidence on both sides of the question.

Left-handedness has popularly been conceived of as inherited, because of the easily observable tendency to run in families—the Kerrs of Scotland, for example, who built their castles with spiral staircases that turned in the direction to accommodate left-handers. The British royal family is a highly visible example: Queen Victoria, King George II, King George VI, Prince William of Wales. Prince William has said that he wants his son little George to be left-handed too as “all the cleverest people are.” He said he will have to teach him to use his left hand, “to make sure he does well in his exams.”

Do family patterns settle the question? Not really. Two right-handed parents have about a 10% chance of having a NRH child. If the father is left-handed but the mother is right-handed, the chance is still about 10%. If the mother is left-handed the likelihood of having a non-right-handed child is doubled to about 20%. If both parents are left-handed, the chance that a child will be left-handed rises to close to 50%. This shows a strong probability of an inherited—that is to say genetic—basis for handedness. However, it does not conform to Mendelian models. If RH is a dominant gene and NRH is a recessive gene, two left-handed parents could not have a right-handed child, and yet slightly more than half of the children of two left-handed parents are right-handed.

The gene for handedness, assuming it exists, has yet to be identified. Researchers at Oxford University

claimed to have found significantly strong association with right- or left-handedness in the gene PCSK6. However, the University of Nottingham's Prof. John Armour and Dr. Angus Davison, and University College of London's Prof. Chris McManus, state that they have ruled out a "strong genetic determinant" in influencing handedness; they studied the whole genome of approximately 4,000 subjects but were unable to find a strong genetic factor in determining handedness.

Many  
twentieth-century  
British and  
American educators,  
psychologists,  
and psychiatrists  
advocated forcing  
left-handed children  
to write with their  
right hands.

If genetics played a dominant role in determining left- or right-handedness, scientists would expect to see a difference in the part of the genome that influences this trait. One researcher said that if there is a gene for handedness, he doesn't know where it is hiding. Some conclude that handedness is polygenic and many different loci may contribute to determining this characteristic.

The late child psychiatrist Dr. Abraham Blau believed that right-handedness is a learned pattern of behaviors passed down from generation to generation, so therefore left-handedness must be evidence of an inability to learn, poor education, or a

negative personality. Some experts asserted that a child's decision to rely on his or her left hand was a reflection of a defiant personality, what Blau termed "negativistic sinistrality," that springs from a contrary emotional attitude to the learning of right-handedness. This childish obstructionism should be corrected by forcible switching, he argued.

Blau was not alone. Many twentieth-century British and American educators, psychologists, and psychiatrists advocated forcing left-handed children to write with their right hands. The methods used to "retrain" recalcitrant left-handers included restraining a child's left hand or having a patrolling teacher armed with a ruler rap the knuckles of a child who tried to write with his or her left hand. In some cases this was done to correct the "error" of left-handedness, which was considered either as a malady or, in the case of many Catholic schools, a sin, since the left side was the devil's side.

In other cases, this was done out of a desire to be helpful to the child, since languages that are written left-to-right, like English—and the overwhelming majority of the world's languages-- are more difficult to write with the left hand. The majority of left-handed people twist their wrists clockwise, so they're writing from above in order to see what they are writing. This form of writing, known as crabclaw, leads to smeared ink (or smudged graphite), and is uncomfortable. The left-hander has to push his pen or pencil across the paper rather than pull it, and some ball-point pens are uncooperative when pushed. Before left-handed desks began to make their way into classrooms, left-handed students had to suspend their arm in the air for hours as they worked.

Insisting that the child use his or her right hand was kindly meant, since that was plainly the "correct" way to do it. Such insistence was not always well

received by left-handed students, however. Eudora Welty writes in *One Writer's Beginnings*:

Before  
left-handed desks  
began to make  
their way into  
classrooms,  
left-handed students  
had to suspend  
their arm in the  
air for hours as  
they worked.

I'd been born left-handed, but the habit was broken when I entered the first grade in Davis School. My father had insisted. He pointed out that everything in life had been made for the convenience of right-handed people because they were the majority, and he often used "what the majority wants" as a criterion for what was best. My mother said that she could not promise him, could not promise at all, that I wouldn't stutter as a consequence. Mother had been born left-handed too; her family consisted of five left-handed brothers, a left-handed mother, and a father who could write with both hands at the same time, also backwards and forwards and upside down, different words with each hand. She had been broken of it when she was young, and she said she used to stutter. (Welty 25)

At the University of British Columbia in Vancouver, Dr. Stanley Coren, a psychologist, has been working for years to document his view that left-handedness has little to do with genetic

variables and almost everything to do with prenatal traumas or birth complications that damage the fetus. He posits that human beings are intended to be right-handed, but certain “stressors” impede the development of right-handedness, e.g., premature birth, breech birth, low birth weight, or Caesarian delivery, among others.

In the last  
25 years,  
however,  
some have  
drawn more  
positive  
associations  
with  
left-handedness.

NRH, in this view, is a digression or aberration from what nature intends. There was an outcry of protest as Coren’s work, which casts NRH as a pathological condition, became widely known, chiefly from people who don’t think left-handers should be considered “damaged goods.” To try to avoid the negative implications of “pathological” the research group put forth the terms “normal” and “alinormal,” in which “ali-“ means “elsewhere” or “otherwise.” The terms do not seem to have caught on, however, and in spite of his recommending more neutral language, Coren’s language describing his work continues to reflect his feeling that NRH has a pathological basis. He says that while NRH is not itself a pathology, it is a soft sign in the sense that an individual who shows it is more likely to have some pathological condition than a person who does not show this behavioral sign.

There is a lot of evidence to support Coren’s theory. Some psychological or

behavioral problems (alcoholism, drug abuse, depression, heightened anxiety, emotionality, sleep difficulties, learning disabilities, schizophrenia, psychosis) and some physical ones (allergies, epilepsy, migraines, slow physical development, shortened life span) are likelier to occur in the NRH population, and might be a result of early neurological injury. Coren’s assumption is that the same trauma or injury that resulted in left-handedness has also resulted in other problems and difficulties.

In the last 25 years, however, some have drawn more positive associations with left-handedness. Although the association between NRH and low intelligence is well documented, Camilla Benbow at Iowa State has been studying extremely bright high school students, and when she looked at SAT scores that would place a student at the top of 10,000 students, she found that this group was twice as likely to be left-handed. Studies in the U.K., U.S. and Australia have revealed that left-handed people average only one IQ point higher than right-handers, but they are clustered at the extremes of the IQ scale, very low IQ or very high IQ.

\* \* \*

The negative stereotypes about left-handedness alluded to above have a long history. Since right-handers are in the majority, the way they do things is considered “right,” and the minority, obviously “wrong.” In English, the word “sinister” derives from the Latin word for “left,” and “gauche” is the French word for “left.” English colloquialisms for left-handed include “skivvy-handed,” “scrummy-handed,” “kaggy-fisted,” “cawk-fisted,” “gibble-fisted,” “southpaw,” “cackhanded.” Most associations with left are negative. We speak of a left-handed compliment. The devil uses his left hand; witches are left-handed. Nor are the negative stereotypes about left-handers confined just to Western cultures and western languages.

Why is it that left-handers are perceived not just as clumsy and feeble, but sometimes as evil? The awkwardness may be real, as they navigate an environment designed for the right-handed majority, or just perceived, as the right-hander sees that way of doing something as “wrong.” But why evil? Is this just evidence of one of mankind’s less endearing characteristics, the tendency to see the “other” group in negative terms and think of it as hostile or threatening?

Studies in the  
U.K., U.S. and  
Australia have  
revealed that  
left-handed people  
average only one  
IQ point higher  
than right-handers,  
but they are  
clustered at the  
extremes of the IQ  
scale, very low IQ or  
very high IQ.

In 1903, the influential Italian criminologist Cesare Lombroso claimed that left-handedness was connected with feeble-mindedness, mental illness, and criminality. A good deal of his work was later discredited (as discussed in Stephen Gould’s *The Mismeasure of Man*), but the connection between left-handedness and pathology gained renewed legitimacy in the 1980s when Harvard University neurologist Norman Geschwind published his studies connecting left-handedness with both physical and psychological problems: autoimmune diseases, psychiatric disorders, mental retardation, and learning disabilities.



After Geschwind, a number of researchers pursued connections of left-handedness with disorders such as schizophrenia, autism, attention deficit disorders, dyslexia, stuttering, and Tourette syndrome. In commenting on these studies, Howard Kushner of Emory University quipped, "If this connection is robust, left-handedness may be one of the greatest threats to the mental health of our planet's population."

\* \* \*

Among researchers in the field of handedness, vigorous debate continues about its cause, whether it is genetic or environmental. The failure by scientists studying the genome to isolate the gene has lent support to those who favor environmental causes, such as prenatal and birth trauma.

One theory that has emerged recently might resolve the failure of handedness to follow the Mendelian models of dominant and recessive genes. Dr. Amar J. S. Klar, a geneticist who believes strongly that handedness is inherited, hypothesizes that humans have a specific dominant gene that makes them right-handed. Klar's theory is that about 20% of people lack the right-handed gene, and these people without the gene have a 50-50 possibility -- a random chance -- of being right-handed or left-handed. Whether a person has or lacks this gene, Dr. Klar supposes, is a function of conventional genetics, just like eye color or baldness. This theory will explain an anomaly that has long stumped geneticists: 18 percent of identical twins, who have exactly the same genetic makeup, have different handedness. The explanation is that these twins lack the right-handed gene, and each has an equal chance of being right-handed or left-handed.

Dr. Daniel H. Geschwind, neurologist at the University of California at Los Angeles, believed that handedness was strongly influenced by genetics but

doubted a single gene was responsible, as Dr. Klar suggests. He gives more weight than Dr. Klar to developmental factors. "Handedness is a complex behavior," Dr. Geschwind said, "and no complex behavior has ever been shown to be due to only a single gene without any environmental influence."

The failure  
by scientists  
studying the  
genome to  
isolate the gene  
has lent support  
to those who favor  
environmental  
causes, such as  
prenatal and  
birth trauma.

We do not have a final answer in the "genetic" vs. "environmental" debate. Since left-handers comprise 10% of the population or less, the tendency of NRH to run in families and the fact that nearly half the children of two left-handed parents will be left-handed indicate a genetic link so strongly that the possibility cannot be ignored.

On the other hand, studies that link NRH to purely physical conditions, such as autoimmune diseases, support the theory of mild neurological damage in utero or in the birth process that interfered with the development of normal right-handedness along with causing other physical problems.

Perhaps some portion of the NRH population has inherited its handedness; they are genetically determined, by Klar's model or another.

Prenatal and birth stressors also seem to correlate to non-right-handedness, as suggested by Coren. The presence of this group in the NRH population would raise the incidence of those disorders that might stem from mild neurological damage.

With all the work being done in the field, it is likely we will have some reliable answers eventually.

## Works Cited

- Benbow, C. P. "Physiological correlates of extreme intellectual precocity." *Neuropsychologia*, 24, 719-725, 1986.
- Blau, Abram. *The Master Hand: a study of the origin and meaning of left and right sidedness and its relation to personality and language*. New York: American Orthopsychiatric Association, 1946.
- Coren, Stanley. *The Left-Hander Syndrome: The Causes and Consequences of Left-Handedness*. The Free Press/Macmillan, 1992.
- Geschwind, Daniel, et. al. "Heritability of lobar brain volumes in twins supports genetic models of cerebral laterality and handedness." *Proceedings of the National Academy of Sciences USA*, 2002.
- Geschwind, Norman. "Left-handedness: association with immune disease, migraine and developmental learning disorder." *Proceedings of the National Academy of Sciences of the United States*.
- Gould, Stephen Jay. *The Mismeasure of Man*. NY: W. W. Norton, 1981.
- Grant, Bob. "On the Other Hand." *The Scientist*, September 2014.
- Klar, Amar J.S. "An epigenetic hypothesis for human brain laterality, handedness, and psychosis development." *Cold Spring Harbor Symposia on Quantative Biology* 2004. LXIX: 499-506.
- Kushner, Howard I. *Talent and Deficit: The Anomalies of Left-Handedness*. Produced by Academic Exchange, Emory University, 2012.
- Lombroso, Cesare. *Crime: Its Causes and Remedies*. Henry P. Horton, trans. Boston: Little, Brown, and Company, 1911.
- Rife, D.C. "Handedness, with Special Reference to Twins." *Genetics* 25: 178-186, 1939.
- Welty, Eudora. *One Writer's Beginnings*. 1983. Cambridge, MA: Harvard U P, 1995.

---

*The publication of this article is funded by  
The Torch Foundation*