A Look at Hand Preference in *Homo Sapiens*

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In a typical class of twenty-five to thirty-five students, an average of three or four will be left-handed (sinistral). These individuals may be the outspoken room leaders or the class clowns, or, perhaps, shy individuals sitting in the corner of the room, but all of them will express a high degree of independence. Psychologists have noted this tendency for some time but only recently have attempted to explain it.

Theorists on the subject presently believe that, due to the enormous population imbalance favoring right handers (dextrals), lefties have had to resist change consistently. In resisting adaptation to using their right hand, left-handers have suffered an environmental-physical disadvantage in practically everything they do, often leading to psychological problems. Fincher (1977) states that left-handed children generally have more physical, emotional and behavioral problems in the early years of their lives than do right-handed children. Furthermore, Fincher reports that many more lefties than statistically expected are bedwetters, insomniacs, alcoholics, stutterers and poor achievers.

Indeed, favoring one's left hand does place the individual at a disadvantage in today's world. Seemingly everything around the person, from kitchen implements to playing cards, is designed for right-handers (Table 1). Even the way the bathroom faucet turns is oppositional to the lefties' natural turning tendency. This trend has persisted for generations without change. Historians relate that as far back as Roman times there was pressure on sinistral individuals to conform (Brown 1979). Military uniforms, weapons, eating utensils and even children's games from the Roman Empire reflect a right-hand preference. Indeed, it was the Romans who developed the right-handed handshake and the right-handed salute. Further, the Latin word "sinister" referred to distrust and underhandedness, while "masturbation" meant to manipulate with the left hand.

Dictionaries and thesauri, generally considered the backbone of academia and scholarship, have contributed equally to the plight of the left-hander. Websters' Third International Dictionary includes such phrases as: "marked with clumsiness; exhibiting deviousness; given to malevolent scheming; and underhanded," while the fourth edition of Roget's Thesaurus lists "sinistral," "ambiguous," "doubtful," "awkward" and "unlucky" as synonyms for left-handed. Furthermore, most of the languages of the world list derogatory synonyms for "left." The French word, "gauche," and the German word, "linkisch," for example, not only mean lefthanded, but also ugly, clumsy and awkward. The Welsh word, "lyft," also indicates insincere and evil. Similarly, "left" in Italian ("malcino") and Spanish ("zurdo") can also mean incorrect, dubious and dishonest.

Religion and the arts have furthered this slanderous sentiment. The Christian Bible has several hundred references to "right" and only a few to "left." In every instance the phrases that include "right" are positive and generally well-meaning, while those that contain the word "left" carry negative connotations. An outstanding example of this vilification occurs in Matthew 25:33: "And he shall place the sheep at His right hand and the goats at His left;" 34: "Then He will say to those at the right hand, Come, O blessed, inherit the kingdom . . .;" 41: "Then He will say to those at the left hand, depart from me, you cursed, into the external fire . . ." Religious art reflects this trend even more, as when Christ is depicted bestowing blessings with his right hand and condemnations with his left (ie: Artés's *The Last Judgment*) or when Christ is shown reaching his life-giving right hand toward Adam's limp, inanimate left (ie: Michelangelo's *Creation of Man*). Mary is generally drawn holding Jesus in her right arm (ie: Van der Weyden's *Madonna and Child*), while Eve is always depicted receiving the forbidden fruit with

her left hand (ie: Coxcie's *Original Sin*).

Interestingly, hand preference seems to be peculiar to human beings. Behavioralists have found that most animals are ambidexterous, or, in those species where hand favoritism is seen, it seems to be split equally between dextral and sinistral. Noted neuropsychologists Levy and Gur (1980) found that in *Homo sapiens* hand preference is not found until around the fourth year, when a usage trend in favor of the right hand generally occurs. During the months that follow, the usage of the right hand is constantly reinforced and hand preference is firmly entrenched by the age of six. Blau (1974) took this concept a step further and suggested that throughout life, individuals perform simple tasks equally well with either hand. Sampling more than 500 children, Blau found almost an even split in hand usage in simple chores such as reaching for a ball or picking up a pencil. This pattern, however, quickly collapsed when the participants performed more sophisticated tasks, such as rolling a ball forward into a hole.

Folklore Hypotheses Addressing Handedness

There has been much speculation about the cause of this manual preference imbalance. It was, perhaps, Plato who first tried to explain dextral dominance. Plato contended that mothers most frequently hold their infants in their right arms. This position tended to pin the youngster's left arm to the mother's chest, rendering it more difficult to move. British historian Thomas Carlyle (1843) proposed that the trend favoring dextral began during tribal wars. Carlyle contended that the early combatants wore their shield over their left arm to better protect their hearts, thus freeing the right hand to wield a sword or mace. Over the centuries, the right hand became swifter and more agile.

More recently, Carl Sagan (1978) suggested that the personal hygiene habits of early humans influenced a manual preference. According to Sagan, medieval populations generally took care of their unpleasant body functions such as cleaning the genitals or the anus after defecation with the left hand. As a rule, this same hand was never utilized for more pleasant tasks such as eating or greeting another. This preference led to the association of left with the unattractive, unaesthetic and potentially harmful. Even today many primitive socieities consider the left hand evil and never feed themselves or touch a colleague with it.

Another early hypothesis implicated the disproportionate distribution of organs within the body as the culprit for right hand preference (Gardner 1969). Accordingly, the uneven placement of such viscera as the liver to the right side of the median plane shifts the center of gravity slightly to the right. Under this stressful alignment, the body tends to compensate by shifting its weight more often to the left foot for balance. This stance favors usage of appendages on the right side of the body's midline.

TABLE 1

A PARTIAL LISTING OF CONTEMPORARY ITEMS DESIGNED WITH A DEXTRAL PREFERENCE

Wristwatch stems	Doorknobs
School desks	Can openers
Corkscrews	Cameras
Match books	Jar tops
Gear shifts	Apple corers
Rulers	Violins
Gravy boats	Scissors
Wrenches	Power saws
Phone booths	Pouring lips on frypans
Pencil sharpeners	Voting machines
Baseball gloves	Vegetable peelers
TV and radio dials	Ice cream scoops
Moustache mugs	Power sanders
Hand drills	Guitars
Golf clubs	Screws
Gum & candy wrappers	Saxophones
Playing cards	Meat grinders
Slot machines	Soup ladles
Books & cards	Fishing reels

A contemporary argument insists that primary school teachers over the decades have so consistently discouraged (often forcefully) left hand usage that large proportions of sinistral children become dextrals by the time they reach adolescence (Lord 1985).

No matter how logical each of these hypotheses sounds, science does not presently consider any to be the cause of the disproportionate manual preference in humans. Major dissuaders are Coren and Porac (1977), who found that the proportion of dextrals and sinistrals in the world's population has not changed significantly for more than fifty centuries.

Scientific Hypotheses Addressing Handedness

Coren and Porac's research suggests that some time-honored and consistent force is responsible for hand preference in humans. Research, therefore, has turned to genetics for an explanation. Bliss and Morella (1980) mentioned the existence of century-old sinistral pedigrees in Scotland, while Trotter (1974) reported genetic control of hand preference in studies of identical twins raised in separate environments. Annett (1972) contended that allelic factors were responsible for the shift from preschool ambi-

dextrous behavior to dextral or sinistral domination by the age of five. Turkewitz and Creighton (1974) suggest that newborns innately prefer to lie on their left sides and, therefore, can move their right appendages more easily. The greater movement on the right leads to greater muscular development and better agility on that side and, subsequently, establishes a preference for the right.

Levy and Reid (1976) have suggested that hand preference is genetically influenced by the writing and linguistic hemisphere of the brain. Arguing that it is biologically more economical for manual activity to originate from the brain's linguistic hemisphere, they contend that the written word is directed from the same side of the brain as the spoken word. Many researchers believe that in the majority of individuals verbal thinking is directed from the left side of the cerebrum (Springer & Deutsch 1981, Lord 1986). Levy and Reid report further that about 8 percent of the population writes in an inverted or hooked position while 92 percent write in an noninverted manner. With this in mind, the researchers hypothesize that in the individuals who write in an inverted fashion the speech center is located in the opposite neural hemisphere from the preferred hand's motor center. Statistically, 70 percent of left-handers write in an inverted fashion. Accordingly, speech in these individuals is controlled by the left cerebral hemisphere and, therefore, must cross the corpus callosum to the right hemisphere to be perceived by the left hand. Similarly the two percent of the right-handers who write invertedly would have contralateral motor-linguistic anatomy. The ratio of inverted to noninverted sinistrals and dextrals in countries where written script flows from right to left (such as Hebrew) is the same as in countries where script flows from left to right. This fact destroys the argument that the hooked writing posture is used in order to see what was just written.

The major obstacles in a genetic hypothesis for manual dominance are the statistical ratios generated by the parent-offspring genotypes. Geneticists report that the probability of two right-handed parents having a left-handed child is very low—only about two percent. However, if one parent is left-handed, the chance of a left-handed offspring increases to 17 percent. When both parents are sinistrals, the chance for a left-handed child climbs to 50 percent (Barsley 1976). On the surface, such data would lead one to consider a genetic involvement for hand preference. However, when one closely examines the above percentages it becomes obvious that the classical Mendelian ratios are not followed. Further, when monozygotic (identical) twins' hand preferences are examined, no difference is found from hand preference ratios in dizygotic twins or even related siblings. In fact, about 25 percent of the monozygotic twins contain a representative of each category—that is, one right-hander and one left-hander (Scheinfeld 1972).

This finding has lead some investigators to postulate that mirrored cytoplasmic gradients are responsible for handedness (Corballis & Morgan 1977). Proponents of this theory contend that dextralism and a sinistralism arise from specific chemical gradients around a bilateral axis early in the formation of an embryo. If, early in cleavage, two individuals develop from one zygote as with monozygotic twins, one individual will grow from the right gradient and the other will arise from the left gradient. This theory would help explain why siamese monozygotes are always dimorphic in their hand preference (Springer & Deutsch 1981). Indeed, it has even been suggested that all singleton left-handers are the surviving members of a monozygotic mirror image twin (Koch 1966).

Baken (1973) also suggests an embryonic origin for handedness. Baken contends that hand preference lies in intrauteral and parturition difficulties. Accordingly, the more stressful the fetus' internal existence and birth, the greater potential there is for restrictive oxygen flow to the brain. If this happens, the infant's left-right cerebral structures may forfeit some responsibilities to areas in the opposite hemisphere. Baken suggests that one trait that resides in the left hemisphere and is frequently relinquished to the right is manual preference. This hypothesis gains credence when clinical records from psychological problem patients are examined. These records indicate that almost 25 percent of epileptics, dyslexics and neurologically impaired individuals are left-handed. This ratio is twice as great as the expected proportion.

The vast majority of behavioral psychologists and biologists today suspect that left-handedness may be caused by several of the above hypotheses. Historical records clearly indicate that left-handedness has run in some families for generations, thereby supporting a genetic linkage. However, the evidence for an environmental influence on manual preference is strong. Whereas genetic left-handers tend to express a mirrored laterality to right-handers, environmentally influenced sinistrals are much more ambidextrous for most tasks they perform. This population is also much more bilateral in neurological symmetry and, therefore, has much more diverse thinking and behavioral patterns (Kulas 1974).

Determining Hand Preference

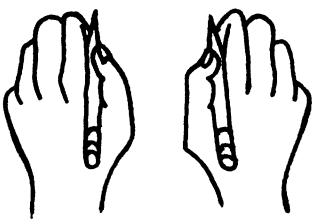
It is often not easy to determine one's manual preference. Contemporary behavioralists contend that the hand used in writing is not a reliable measure of sinistry or dextrality, because of domination of the brain's linguistic hemisphere. DeKay (1974) recently noted that writing preference is an accurate indicator

FIGURE 1

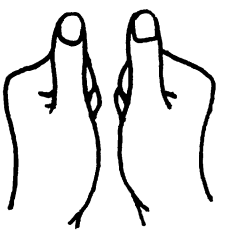
ARE YOU SURE YOU KNOW WHICH IS YOUR DOMINANT HAND?

When attempts are made to determine one's dominant hand, one or more of the below tests are generally performed. However, the conclusion is often dependant on which of the below tests were utilized in the study. It is not uncommon for a subject to show right hand dominance for three of the tests and left hand dominance for two. How do you measure up?

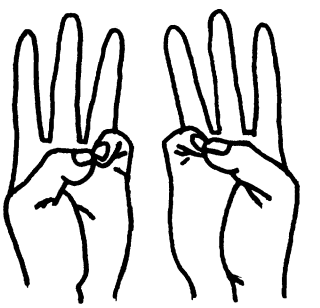
TEST A: The hand used in writing is the most frequently used determiner of hand dominance. The statistically accepted ratio of one in ten people being left handed was determined by this measure.



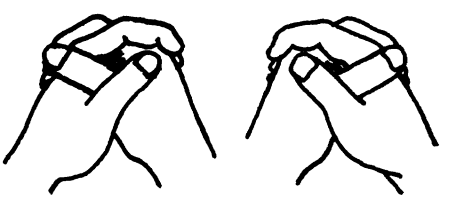
TEST B: Hold the two thumbs side by side and observe the base of the thumb nails. The dominant hand's thumb will have a more squared base.



TEST C: Extend the thumb across the palm and touch the little finger on each hand. The finger-thumb angle nearer 180° (the straighter) is on the dominant hand.



TEST D: Fold the hands so that the fingers interlock. The thumb on the dominant hand will cover the thumb on the recessive hand.



TEST E: With a pencil draw a circle around the x's; use the right hand around the right x and left hand around the left x. Dominant right handers should draw two counterclockwise circles while true left handers should draw two clockwise circles. One circle in each direction indicates hand dominant indecision.

X **X**

of handedness in only about 30 percent of the cases. Such measures as the hand that excels in fine, precise activity, the hand that is stronger and more agile, or the hand that is preferred in learning a new task have also been found to be unreliable. Figure 1 lists several tests that have been utilized by researchers to help determine a participant's hand preference.

Unfortunately, an unfair stereotype concerning left-handers persists. When teenagers were asked to place words from a listing on the blackboard under either a column marked RIGHT or a second column marked LEFT, the results were consistent. The participants listed such words as "sacred," "strong," "beautiful" and "life" under the RIGHT column and "profane," "weak," "limp," and "death" under the LEFT column (Domhoff 1970). When adults were asked to describe the physical appearance of criminals, they listed low forehead, close set eyes, unshaven beard and left handedness as characteristics (Lord 1985). Finally, slanderous expressions involving the word "left" still prevail today. Sayings such as "the left hand of fortune" (unlucky), "the left hand of friendship" (hostile toward friends), and "a child of the left hand" (illegitimate child) are frequently uttered in everyday conversation (Herron 1976).

Left-handers make up a sizable population in this country—a group of well over 25 million people. Among their ranks are such present day notables as George Bush, Gerald Ford, Bruce Jenner, Caroline Kennedy, Sandy Koufax, Kim Novak, Robert Redford and two of the Beatles (Paul & Ringo). Such historic characters as Alexander the Great, Charlemagne, Michaelangelo, Leonardo Da Vinci, Lord Nelson and Queen Victoria were left-handed. Obviously, left-handers have made outstanding contributions to the quality of human life. Yet, in many countries they continue to be looked upon with suspicion and ridicule. It is indeed time that the world cast off the ancient and unjust stereotypes concerning its sinistral people.

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