

is strongly linked with concepts of anarchy and feelings that are out of conscious control—somehow bad, immoral, and dangerous.

Until very recently, the ancient bias against the left hand/right hemisphere sometimes even led parents and teachers of left-handed children to try to force the children to use their right hands for writing, eating, and so on—a practice that often caused problems lasting into adulthood.

Throughout human history, terms with connotations of good for the right hand/left hemisphere and connotations of bad for the left hand/right hemisphere appear in most languages around the world. The Latin word for left is *sinister*, meaning “bad,” “ominous,” “treacherous.” The Latin word for right is *dexter*, from which comes our word “dexterity,” meaning “skill” or “adroitness.”

The French word for left—remember that the left hand is connected to the right hemisphere—is *gauche*, meaning “awkward,” from which comes our word “gawky.” The French word for right is *droit*, meaning “good,” “just,” or “proper.”

In English, left comes from the Anglo-Saxon *lyft*, meaning “weak” or “worthless.” The left hand of most right-handed people is in fact weaker than the right, but the original word also implied lack of moral strength. The derogatory meaning of left may reflect a prejudice of the right-handed majority against a minority of people who were different, that is, left-handed. Reinforcing this bias, the Anglo-Saxon word for right, *reht* (or *riht*), meant “straight” or “just.” From *reht* and its Latin cognate *rectus* we derived our words “correct” and “rectitude.”

These ideas are also reflected in our political vocabulary. The political right, for instance, admires national power, is conservative, and resists change. The political left, conversely, admires individual autonomy and promotes change, even radical change. At their extremes, the political right is fascist, the political left is anarchist.

In the context of cultural customs, the place of honor at a formal dinner is on the host’s right-hand side. The groom stands on the right in the marriage ceremony, the bride on the left—a non-

verbal message of the relative status of the two participants. We shake hands with our right hands; it seems somehow wrong to shake hands with our left hands.

Under “left-handed,” the dictionary lists as synonyms “clumsy,” “awkward,” “insincere,” “malicious.” Synonyms for “right-handed,” however, are “correct,” “indispensable,” and “reliable.” Now, it’s important to remember that these terms were all made up, when languages began, by some persons’ left hemispheres—the left brain calling the right bad names! And the right brain—labeled, pinpointed, and buttonholed—was without a language of its own to defend itself.

Two ways of knowing

Along with the opposite connotations of left and right in our language, concepts of the duality, or two-sidedness, of human nature and thought have been postulated by philosophers, teachers, and scientists from many different times and cultures. The key idea is that there are two parallel “ways of knowing.”

You probably are familiar with these ideas. As with the left/right terms, they are embedded in our languages and cultures. The main divisions are, for example, between thinking and feeling, intellect and intuition, objective analysis and subjective insight. Political writers say that people generally analyze the good and bad points of an issue and then vote on their “gut” feelings. The history of science is replete with anecdotes about researchers who try repeatedly to figure out a problem and then have a dream in which the answer presents itself as a metaphor intuitively comprehended by the scientist. The statement on page 39 by Henri Poincaré is a vivid example of the process.

In another context, people occasionally say about someone, “The words sound okay, but something tells me not to trust him (or her).” Or “I can’t tell you in words exactly what it is, but there is something about that person that I like (or dislike).” These statements are intuitive observations that both sides of the brain are at work, processing the same information in two different ways.

Parallel Ways of Knowing

intellect	intuition
convergent	divergent
digital	analogic
secondary	primary
abstract	concrete
directed	free
propositional	imaginative
analytic	relational
lineal	nonlinear
rational	intuitive
sequential	multiple
analytic	holistic
objective	subjective
successive	simultaneous

—J. E. Bogen
“Some Educational
Aspects of Hemisphere
Specialization” in *UCLA
Educator*, 1972

The Duality of Yin and Yang

<i>Yin</i>	<i>Yang</i>
feminine	masculine
negative	positive
moon	sun
darkness	light
yielding	aggressive
left side	right side
cold	warm
autumn	spring
winter	summer
unconscious	conscious
right brain	left brain
emotion	reason

—*I Ching* or *Book of Changes*,
a Chinese Taoist work

Dr. J. William Bergquist, a mathematician and specialist in the computer language known as APL, proposed in a paper given at Snowmass, Colorado, in 1977 that we can look forward to computers that combine digital and analog functions in one machine. Dr. Bergquist dubbed his machine "The Bifurcated Computer." He stated that such a computer would function similarly to the two halves of the human brain.

"The left hemisphere analyzes over time, whereas the right hemisphere synthesizes over space."

— Jerre Levy
"Psychobiological
Implications of Bilateral
Asymmetry," 1974

"Every creative act involves . . . a new innocence of perception, liberated from the cataract of accepted belief."

— Arthur Koestler
The Sleepwalkers, 1959

The two modes of information processing

Inside each of our skulls, therefore, we have a double brain with two ways of knowing. The dualities and differing characteristics of the two halves of the brain and body, intuitively expressed in our language, have a real basis in the physiology of the human brain. Because the connecting fibers are intact in normal brains, we rarely experience at a conscious level conflicts revealed by the tests on split-brain patients.

Nevertheless, as each of our hemispheres gathers in the same sensory information, each half of our brains may handle the information in different ways: The task may be divided between the hemispheres, each handling the part suited to its style. Or one hemisphere, often the dominant left, will "take over" and inhibit the other half. The left hemisphere analyzes, abstracts, counts, marks time, plans step-by-step procedures, verbalizes, and makes rational statements based on logic. For example, "Given numbers a, b, and c—we can say that if a is greater than b, and b is greater than c, then a is necessarily greater than c." This statement illustrates the left-hemisphere mode: the analytic, verbal, figuring-out, sequential, symbolic, linear, objective mode.

On the other hand, we have a second way of knowing: the right-hemisphere mode. We "see" things in this mode that may be imaginary—existing only in the mind's eye. In the example given just above, did you perhaps visualize the "a, b, c" relationship? In visual mode, we see how things exist in space and how the parts go together to make up the whole. Using the right hemisphere, we understand metaphors, we dream, we create new combinations of ideas. When something is too complex to describe, we can make gestures that communicate. Psychologist David Galin has a favorite example: try to describe a spiral staircase without making a spiral gesture. And using the right-hemisphere mode, we are able to draw pictures of our perceptions.

My students report that learning to draw makes them feel more "artistic" and therefore more creative. One definition of a creative person is someone who can process in new ways information directly at hand—the ordinary sensory data available to

all of us. A writer uses words, a musician notes, an artist visual perceptions, and all need some knowledge of the techniques of their crafts. But a creative individual intuitively sees possibilities for transforming ordinary data into a new creation, transcendent over the mere raw materials.

Time and again, creative individuals have recognized the differences between the two processes of gathering data and transforming those data creatively. Neuroscience is now illuminating that dual process. I propose that getting to know both sides of your brain is an important step in liberating your creative potential.

The Ah-ha! response

In the right-hemisphere mode of information processing, we use intuition and have leaps of insight—moments when "everything seems to fall into place" without figuring things out in a logical order. When this occurs, people often spontaneously exclaim, "I've got it" or "Ah, yes, now I see the picture." The classic example of this kind of exclamation is the exultant cry, "Eureka!" (I have found it!) attributed to Archimedes. According to the story, Archimedes experienced a flash of insight while bathing that enabled him to use the weight of displaced water to determine whether a certain crown was pure gold or alloyed with silver.

This, then, is the right-hemisphere mode: the intuitive, subjective, relational, holistic, time-free mode. This is also the disdained, weak, left-handed mode that in our culture has been generally ignored. For example, most of our educational system has been designed to cultivate the verbal, rational, on-time left hemisphere, while half of the brain of every student is virtually neglected.

Half a brain is better than none: A whole brain would be better

With their sequenced verbal and numerical classes, the schools you and I attended were not equipped to teach the right-hemisphere mode. The right hemisphere is not, after all, under very

The nineteenth-century mathematician Henri Poincaré described a sudden intuition that gave him the solution to a difficult problem:

"One evening, contrary to my custom, I drank black coffee and could not sleep. Ideas rose in crowds; I felt them collide until pairs interlocked, so to speak, making a stable combination." [That strange phenomenon provided the intuition that solved the troublesome problem. Poincaré continued.] "It seems, in such cases, that one is present at his own unconscious work, made partially perceptible to the overexcited consciousness, yet without having changed its nature. Then we vaguely comprehend what distinguishes the two mechanisms or, if you wish, the working methods of the two egos."

"Approaching forty, I had a singular dream in which I almost grasped the meaning and understood the nature of what it is that wastes in wasted time."

—Cyril Connolly
The Unquiet Grave: A Word Cycle by Palinurus, 1945

Many creative people seem to have intuitive awareness of the separate-sided brain. For example, Rudyard Kipling wrote the following poem, entitled "The Two-Sided Man," more than fifty years ago.

Much I owe to the lands that grew—
More to the Lives that fed—
But most to the Allah Who gave me
Two
Separate sides to my head.
Much I reflect on the Good and the
True
In the faiths beneath the sun
But most upon Allah Who gave me
Two
Sides to my head, not one.
I would go without shirt or shoe,
Friend, tobacco or bread,
Sooner than lose for a minute the
two
Separate sides of my head!

—Rudyard Kipling

good verbal control. You can't reason with it. You can't get it to make logical propositions such as "This is good and that is bad, for a, b, and c reasons." It is metaphorically left-handed, with all the ancient connotations of that characteristic. The right hemisphere is not good at sequencing—doing the first thing first, taking the next step, then the next. It may start anywhere, or take everything at once. Furthermore, the right hemisphere hasn't a good sense of time and doesn't seem to comprehend what is meant by the term "wasting time," as does the good, sensible left hemisphere. The right brain is not good at categorizing and naming. It seems to regard the thing as-it-is, at the present moment of the present; seeing things for what they simply are, in all of their awesome, fascinating complexity. It is not good at analyzing and abstracting salient characteristics.

Today, educators are increasingly concerned with the importance of intuitive and creative thought. Nevertheless, school systems in general are still structured in the left-hemisphere mode. Teaching is sequenced: Students progress through grades one, two, three, etc., in a linear direction. The main subjects learners study are verbal and numerical: reading, writing, arithmetic. Nowadays, however, seats often are set circles rather than in rows. Time schedules are more flexible. But learners still converge on "correct" answers to often-ambiguous questions. Teachers still give out grades that often are tied to the "bell curve," which guarantees that one-third of every group will be judged "below average," regardless of achievement. And everyone senses that something is amiss.

The right brain—the dreamer, the artificer, and the artist—is lost in our school system and goes largely untaught. We might find a few art classes, a few shop classes, something called "creative writing," and perhaps courses in music; but it's unlikely that we would find courses in imagination, in visualization, in perceptual or spatial skills, in creativity as a separate subject, in intuition, in inventiveness. Yet educators value these skills and have apparently hoped that students would develop imagination, perception, and intuition as natural consequences of training in verbal, analytic skills.

Fortunately, such development often does occur almost in spite of the school system—a tribute to the survival capacity of creative abilities. But the emphasis of our culture is so strongly slanted toward rewarding left-brain skills that we are surely losing a very large proportion of the potential ability of the other halves of our children's brains. Scientist Jerre Levy has said—only partly humorously—that American scientific training through graduate school may entirely destroy the right hemisphere. We certainly are aware of the effects of inadequate training in verbal, computational skills. The verbal left hemisphere never seems to recover fully, and the effects may handicap students for life. What happens, then, to the right hemisphere that is hardly trained at all?

Perhaps now that neuroscientists have provided a conceptual base for right-brain training, we can begin to build a school system that will teach the whole brain. Such a system will surely include training in drawing skills—an efficient, effective way to teach thinking strategies suited to the right brain.

Handedness, left or right

Students ask many questions about left- and right-handedness. This is a good place to address the subject, before we begin instruction in the basic skills of drawing. I will attempt to clarify only a few points, because the extensive research on handedness is difficult and complicated.

First, classifying people as strictly left-handed or right-handed is not quite accurate. People range from being completely left-handed or completely right-handed to being completely ambidextrous—that is, able to do many things with either hand, without a decided preference. Most of us fall somewhere on a continuum, with about 90 percent of humans preferring, more or less strongly, the right hand, and 10 percent preferring the left.

The percentage of individuals with left-hand preference for handwriting seems to be rising, from about 2 percent in 1932 to about 11 percent in the 1980s. The main reason for this rise is probably that teachers and parents have learned to tolerate left-

"To make biological survival possible, Mind at Large has to be funneled through the reducing valve of the brain and nervous system. What comes out the other end is a measly trickle of the kind of consciousness which will help us to stay alive on the surface of this particular planet. To formulate and express the contents of this reduced awareness, man has invented and endlessly elaborated those symbol-systems and implicit philosophies which we call languages."

—Aldous Huxley
The Doors of Perception

Some famous individuals usually classified as left-handers:

Charlie Chaplin
Judy Garland
Ted Williams
Robert McNamara
George Burns
Lewis Carroll
King George VI of Britain
W. C. Fields
Albert Einstein
Billy the Kid
Queen Victoria
Harry S. Truman
Casey Stengel
Charlemagne
Paul McCartney
Pharoah Rameses II
Cole Porter
Gerald Ford
Cary Grant
Ringo Starr
Prince Charles
Benjamin Franklin
Julius Caesar
Marilyn Monroe
George Bush

Mirror writing reverses the shape of every letter and is written from right to left—that is, backwards. Only when held up to a mirror does it become legible for most readers:

ʎɹɔɔɹ ʎɹɔɔɹ ʎɹɔɔɹ ʎɹɔɔɹ
 ʎɹɔɔɹ ʎɹɔɔɹ ʎɹɔɔɹ ʎɹɔɔɹ
 ʎɹɔɔɹ ʎɹɔɔɹ ʎɹɔɔɹ ʎɹɔɔɹ
 ʎɹɔɔɹ ʎɹɔɔɹ ʎɹɔɔɹ ʎɹɔɔɹ

The most famous mirror-writer in history is the Italian artist, inventor, and left-hander Leonardo da Vinci. Another is Lewis Carroll, left-handed author of *Alice's Adventures in Wonderland* and its sequel, *Through the Looking-Glass and What Alice Found There*, whose mirror-written poem is shown above.

Most right-handers find mirror writing difficult, but it is quite easy for many left-handers.

Try writing your signature in mirror writing.

handed writing and no longer force children to use the right hand. This relatively new tolerance is fortunate, because forcible change can cause a child to have serious problems, such as stuttering, right/left directional confusion, and difficulty in learning to read.

A useful way to regard handedness is to recognize that hand preference is the most visible outward sign of how an individual's brain is organized. There are other outward signs: eyedness (everyone has a dominant eye, used in sighting along an edge, for example) and footedness (the foot used to step off a curb or to start a dance step). The key reason for not forcing a child to use the nonpreferred hand is that brain organization is probably genetically determined, and forcing a change works against this natural organization. Natural preference is so strong that past efforts to change left-handers often resulted in ambidexterity: children capitulated to pressure (in the old days, even punishment) and learned to use the right hand for writing but continued to use the left for everything else.

Moreover, there is no acceptable reason for teachers or parents to force a change. Reasons proffered run from "Writing with the left hand looks so uncomfortable," to "The world is set up for right-handers and my left-handed child would be at a disadvantage." These are not good reasons, and I believe they often mask an inherent prejudice against left-handedness—a prejudice now rapidly disappearing, I'm happy to report.

Putting prejudice aside, there are important differences between left-handers and right-handers. Left-handers are generally less lateralized than right-handers. Lateralization means the degree to which specific functions are carried out almost exclusively by one hemisphere. For example, left-handers more frequently process language in both hemispheres and process spatial information in both hemispheres than do right-handers. Specifically, language is mediated in the left hemisphere in 90 percent of right-handers and 70 percent of left-handers. Of the remaining 10 percent of right-handers, about 2 percent have language located in the right brain, and about 8 percent mediate language in both hemispheres. Of the remaining 30 percent of left-handers, about

15 percent have language located in the right brain, and about 15 percent mediate language in both hemispheres. Note that individuals with right-hemisphere language location—termed right-hemisphere dominance, since language dominates—often write in the "hooked" position that seems to cause teachers so much dismay. Scientist Jerre Levy has proposed that hand position in writing is another outward sign of brain organization.

Do these differences matter? Individuals vary so much that generalizations are risky. Nevertheless, experts agree in general that a mixture of functions in both hemispheres (that is, a lesser degree of lateralization) creates the potential for conflict or interference. It is true that left-handers statistically are more prone to stutter and to experience the reading difficulty called dyslexia. However, other experts suggest that bilateral distribution of functions may produce superior mental abilities. Left-handers excel in mathematics, music, and chess. And the history of art certainly gives evidence of an advantage for left-handedness: Leonardo da Vinci, Michelangelo, and Raphael were all left-handed.



Aztecs in early Mexico used the left hand for medicine for kidney trouble, the right when curing the liver.

From *The Left-Handers' Handbook*, by J. Bliss and J. Morella.



The Incas of ancient Peru considered left-handedness a sign of good fortune.

Former United States Vice President Nelson Rockefeller, a changed left-hander, had difficulty reading prepared speeches because of a tendency to read backward from right to left. The cause of this difficulty may have been his father's unrelenting effort to change his son's left-handedness.

"Around the family dinner table, the elder Mr. Rockefeller would put a rubber band around his son's left wrist, tie a long string on it and jerk the string whenever Nelson started to eat with his left hand, the one he naturally favored."



—Quoted in *The Left-Handers' Handbook* by J. Bliss and J. Morella, 1980

Eventually, young Nelson capitulated and achieved a rather awkward ambidextrous compromise, but he suffered the consequences of his father's rigidity throughout his lifetime.



Mayan Indians were pro-right: the twitching of a soothsayer's left leg foretold disaster.

A comparison of left-mode and right-mode characteristics

L -mode	R -mode
Verbal <i>Using words to name, describe, define.</i>	Nonverbal <i>Using non-verbal cognition to process perceptions.</i>
Analytic <i>Figuring things out step-by-step and part-by-part.</i>	Synthetic <i>Putting things together to form wholes.</i>
Symbolic <i>Using a symbol to stand for something. For example, the drawn form  stands for eye, the sign  stands for the process of addition.</i>	Actual, real <i>Relating to things as they are, at the present moment.</i>
Abstract <i>Taking out a small bit of information and using it to represent the whole thing.</i>	Analogic <i>Seeing likenesses among things; understanding metaphoric relationships.</i>
Temporal <i>Keeping track of time, sequencing one thing after another: Doing first things first, second things second, etc.</i>	Nontemporal <i>Without a sense of time.</i>
Rational <i>Drawing conclusions based on reason and facts.</i>	Nonrational <i>Not requiring a basis of reason or facts; willingness to suspend judgment.</i>
Digital <i>Using numbers as in counting.</i>	Spatial <i>Seeing where things are in relation to other things and how parts go together to form a whole.</i>
Logical <i>Drawing conclusions based on logic: one thing following another in logical order—for example, a mathematical theorem or a well-stated argument.</i>	Intuitive <i>Making leaps of insight, often based on incomplete patterns, hunches, feelings, or visual images.</i>
Linear <i>Thinking in terms of linked ideas, one thought directly following another, often leading to a convergent conclusion.</i>	Holistic <i>(meaning “wholistic”) Seeing whole things all at once; perceiving the overall patterns and structures, often leading to divergent conclusions.</i>

Handedness and drawing

Does left-handedness, then, improve a person's ability to gain access to right-hemisphere functions such as drawing? From my observations as a teacher, I can't say that I have noticed much difference in ease of learning to draw between left- and right-handers. Drawing came easily to me, for example, and I am extremely right-handed—though, like many people, I have some right/left confusion, perhaps indicating bilateral functions. (A person with right/left confusion is one who says “Turn left,” while pointing right.) But there is a point to be made here. The process of learning to draw creates quite a lot of mental conflict. It's possible that left-handers are more used to that kind of conflict and are therefore better able to cope with the discomfort it creates than are fully lateralized right-handers. Clearly, much research is needed in this area.

Some art teachers recommend that right-handers shift the pencil to the left hand, presumably to have more direct access to R-mode. I do not agree. The problems with seeing that prevent individuals from being able to draw do not disappear simply by changing hands; the drawing is just more awkward. Awkwardness, I regret to say, is viewed by some art teachers as being more creative or more interesting. I think this attitude does a disservice to the student and is demeaning to art itself. We do not view awkward language, for instance, or awkward science as being more creative and somehow better.

A small percentage of students do discover by trying to draw with the left hand that they actually draw more proficiently that way. On questioning, however, it almost always comes to light that the student has some ambidexterity or was a left-hander who had been pressured to change. It would not even occur to a true right-hander like myself (or to a true left-hander) to draw with the less-used hand. But on the chance that a few of you may discover some previously hidden ambidexterity, I encourage you to try both hands at drawing, then settle on whichever hand feels the most comfortable.

Sigmund Freud, Hermann von Helmholtz, and the German poet Schiller were afflicted with right/left confusion. Freud wrote to a friend:

“I do not know whether it is obvious to other people which is their own or other's right or left. In my case, I had to think which was my right; no organic feeling told me. To make sure which was my right hand I used quickly to make a few writing movements.”

— Sigmund Freud
The Origins of Psychoanalysis

A less august personage had the same problem:

Pooh looked at his two paws. He knew that one of them was the right, and he knew that when you had decided which one of them was the right, that the other one was the left, but he never could remember how to begin. “Well,” he said slowly . . .

— A. A. Milne
The House at Pooh Corner

Psychologist Charles T. Tart, discussing alternate states of consciousness, has said, "Many meditative disciplines take the view that . . . one possesses (or can develop) an Observer that is highly objective with respect to the ordinary personality. Because it is an Observer that is essentially pure attention/awareness, it has no characteristics of its own." Professor Tart goes on to say that some persons who feel that they have a fairly well-developed Observer "feel that this Observer can make essentially continuous observations not only within a particular d-SoC (discrete state of consciousness) but also during the transition between two or more discrete states."

— "Putting the Pieces Together," 1977

In the chapters to follow, I will address the instructions to right-handers and thus avoid tedious repetition of instructions specifically for left-handers, with no intention of the "handism" that left-handers know so well.

Setting up the conditions for the L→R shift

The exercises in the next chapter are specifically designed to cause a (hypothesized) mental shift from L-mode to R-mode. The basic assumption of the exercises is that the nature of the task can influence which mode will "take up" the job while inhibiting the other hemisphere. But the question is what factors determine which mode will predominate?

Through studies with animals, split-brain patients, and individuals with intact brains, scientists believe that the control question may be decided mainly in two ways. One way is speed: Which hemisphere gets to the job the quickest? A second way is motivation: Which hemisphere cares most or likes the task the best? And conversely: Which hemisphere cares least and likes the job the least?

Since drawing a perceived form is largely an R-mode function, it helps to reduce L-mode interference as much as possible. The problem is that the left brain is dominant and speedy and is very prone to rush in with words and symbols, even taking over jobs which it is not good at. The split brain studies indicated that dominant L-mode prefers not to relinquish tasks to its mute partner unless it really dislikes the job—either because the job takes too much time, is too detailed or slow or because the left brain is simply unable to accomplish the task. That's exactly what we need—tasks that the dominant left brain will turn down. The exercises that follow are designed to present the brain with a task that the left hemisphere either can't or won't do.



And now if e'er by chance I put
My fingers into glue
Or madly squeeze a right-hand foot
Into a left-hand shoe. . . .

— Lewis Carroll
Upon the Lonely Moor, 1856