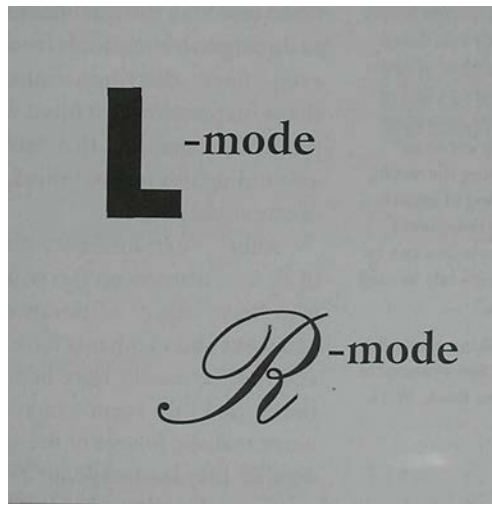
Your Brain:

The Right and Left of It



HOW DOES THE HUMAN BRAIN WORK? That remains the most baffling and elusive of all questions having to do with human understanding. Despite centuries of study and thought and the accelerating rate of knowledge in recent years, the brain still engenders awe and wonder at its marvelous capabilities—many of which we simply take for granted.

Scientists have targeted visual perception in particular with highly precise studies, and yet vast mysteries still exist. The most ordinary activities are awe-inspiring. For example, in a recent contest, people were shown a photograph of six mothers and their six children, arranged randomly in a group. Contestants, strangers to the photographed group, were asked to link the six mother-and-child pairs. Forty people responded, and each had paired all of the mothers and children correctly.

To think of the complexity of that task is to make one's head spin. Our faces are more alike than unlike: two eyes, a nose, a mouth, hair, and two ears, all more or less the same size and in the same places on our heads. Telling two people apart requires fine discriminations beyond the capability of nearly all computers, as I mentioned in the Introduction. In this contest, participants had to distinguish each adult from all the others and estimate, using even finer discriminations, which child's features/head-shape/expression best fitted with which adult. The fact that people can accomplish this astounding feat and not realize how astounding it is forms, I think, a measure of our underestimation of our visual abilities.

"Few people realize what an astonishing achievement it is to be able to see at all. The main contribution of the new field of artificial intelligence has been not so much to solve these problems of information handling as to show what tremendously difficult problems they are. When one reflects on the number of computations that must have to be carried out before one can recognize even such an everyday scene as another person crossing the street, one is left with a feeling of amazement that such an extraordinary series of detailed operations can be accomplished so effortlessly in such a short space of time."

F. H. C. Crick, "Thinking about the Brain," in *The Brain*, San Francisco: A Scientific American Book, W. H. Freeman, 1979, p. 130.

Another extraordinary activity is drawing. As far as we know, of all the creatures on this planet, human beings are the only ones who draw images of things and persons in their environment. Monkeys and elephants have been persuaded to paint and draw and their artworks have been exhibited and sold. And, indeed, these works do seem to have expressive content, but they are never realistic images of the animals' perceptions. Animals do not do still-life, landscape, or portrait drawing. So unless there is some monkey that we don't know about out there in the forest drawing pictures of other monkeys, we can assume that drawing

perceived images is an activity confined to human beings and made possible by our human brain.

Fig. 3-1.

Both sides of your brain

Seen from above, the human brain resembles the halves of a walnut—two similar appearing, convoluted, rounded halves connected at the center (Figure 3-1). The two halves are called the "left hemisphere" and the "right hemisphere."

The left hemisphere controls the right side of the body; the right hemisphere controls the left side. If you suffer a stroke or accidental brain damage to the left half of your brain, for example, the right half of your body will be most seriously affected and vice versa. As part of this crossing over of the nerve pathways, the left hand is controlled by the right hemisphere; the right hand, by the left hemisphere, as shown in Figure 3-2.

The double brain

With the exception of human beings and possibly songbirds, the greater apes, and certain other mammals, the cerebral hemispheres (the two halves of the brain) of Earth's creatures are

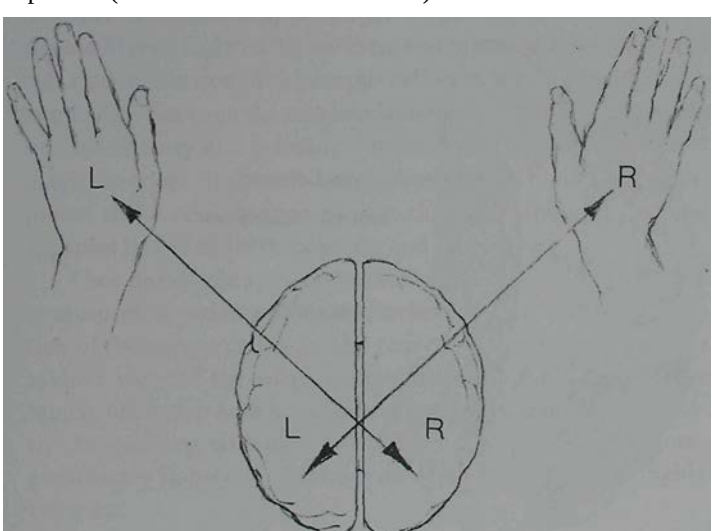


Fig. 3-2. The crossover connections of left hand to right hemisphere, right hand to left hemisphere.

essentially alike, or symmetrical, both in appearance and in function. Human cerebral hemispheres, and those of the exceptions noted above, develop asymmetrically in terms of function. The most noticeable outward effect of the asymmetry of the human brain is handedness, which seems to be unique to human beings and possibly chimpanzees.

For the past two hundred years or so, scientists have known that language and language-related capabilities are mainly located in the left hemispheres of the majority of individuals—approximately 98 percent of right-handers and about two-thirds of left-handers. Knowledge that the left half of the brain is specialized for language functions was largely derived from observations of the effects of brain injuries. It was apparent, for example, that an injury to the left side of the brain was more likely to cause a loss of speech capability than an injury of equal severity to the right side.

Because speech and language are such vitally important human capabilities, nineteenth-century scientists named the left hemisphere the "dominant," "leading," or "major" hemisphere. Scientists named the right brain the "subordinate" or "minor" hemisphere. The general view, which prevailed until fairly

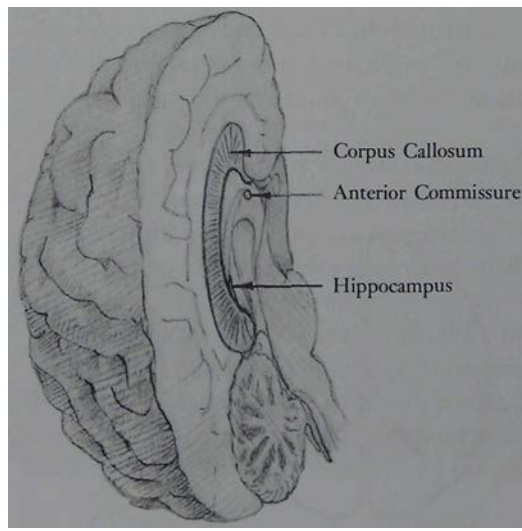


Fig. 3-3. A diagram of one half of a human brain, showing the corpus callosum and related commissures.

recently, was that the right half of the brain was less advanced, less evolved than the left half—a mute twin with lower-level capabilities, directed and carried along by the verbal left hemisphere. Even as late as 1961, neuroscientist. Z. Young could still wonder whether the right hemisphere might be merely a "vestige," though he allowed that he would rather keep than lose his. [Quoted from *The Psychology of Left and Right,* M. Corbalis and Ivan Beale, Hillsdale, NJ: Lawrence Erlbaum Associates, 1976, p. 101.]

A long-time focus of neuroscientific study has been the functions, unknown until fairly recently, of a thick nerve cable composed of millions of fibers that cross-connect the two cerebral hemispheres. This connecting cable, the corpus callosum, is shown in the diagrammatic drawing of half of a human brain, Figure 3-3. Because of its large size, tremendous number of nerve fibers, and strategic location as a connector of the two hemispheres, the corpus callosum gave all the appearances of being an important structure. Yet enigmatically, available evidence indicated that the corpus callosum could be completely severed without observable significant effect. Through a series of animal studies during the 1950s, conducted mainly at the California Institute of Technology by Roger W. Sperry and his students, Ronald Myers, Colwyn Trevarthen, and others, it was established that a main function of the corpus callosum was to provide communication between the two hemispheres and to allow transmission of memory and learning. Furthermore, it was determined that if the connecting cable was severed the two brain halves continued to function independently, thus explaining in part the apparent lack of effect on behavior and functioning.

Then during the 1960s, extension of similar studies to human neurosurgical patients provided further information on the function of the corpus callosum and caused scientists to postulate a revised view of the relative capabilities of the halves of the human brain: that both hemispheres are involved in higher cognitive functioning, with each half of the brain specialized in complementary fashion for different modes of thinking, both highly complex.

As journalist Maya Pines stated in her 1982 book, *The Brain Changers*, "All roads lead to Dr. Roger Sperry, a California Institute of Technology psychobiology professor who has the gift of making—or provoking—important discoveries."

"The main theme to emerge... is that there appear to be two modes of thinking, verbal and nonverbal, represented rather separately in left and right hemispheres, respectively, and that our educational system, as well as science in general, tends to neglect the nonverbal form of intellect. What it comes down to is that modern society discriminates against the right hemisphere."

— Roger W. Sperry
"Lateral Specialization of Cerebral Function in the Surgically Separated Hemispheres," 1973

Because this changed perception of the brain has important implications for education in general and for learning to draw in particular, I'll briefly describe some of the research often referred to as the "split-brain" studies. The research was mainly carried out at Cal Tech by Sperry and his students Michael Gazzaniga, Jerre Levy, Colwyn Trevarthen, Robert Nebes, and others.

The investigation centered on a small group of individuals who came to be known as the commissurotomy, or "split-brain," patients. They are persons who had been greatly disabled by "epileptic seizures that involved both hemispheres. As a last-resort measure, after all other remedies had failed, the incapacitating spread of seizures between the two hemispheres was controlled by means of an operation, performed by Phillip Vogel and Joseph Bogen, that severed the corpus callosum and the related commissures, or cross-connections, thus isolating one hemisphere from the other. The operation yielded the hoped-for result: The patients' seizures were controlled and they regained health. In spite of the radical nature of the surgery, the patients' outward appearance, manner, and coordination were little affected; and to casual observation their ordinary daily behavior seemed little changed.

The Cal Tech group subsequently worked with these patients in a series of ingenious and subtle tests that revealed the separated functions of the two hemispheres. The tests provided surprising new evidence that each hemisphere, in a sense, perceives its own reality—or perhaps better stated, perceives reality in its own way. The verbal half of the brain—the left half—dominates most of the time in individuals with intact brains as well as in the split-brain patients. Using ingenious procedures, however, the Cal Tech group tested the patients' separated right hemispheres and found evidence that the right, nonspeaking half of the brain also experiences, responds with feelings, and processes information on its own. In our own brains, with intact corpus callosa, communication between the hemispheres melds or reconciles the two perceptions, thus preserving our sense of being one person, a unified being.

In addition to studying the right/left separation of inner

mental experience created by the surgical procedure, the scientists examined the different ways in which the two hemispheres process information. Evidence accumulated showing that the mode of the left hemisphere is verbal and analytic, while that of the right is nonverbal and global. New evidence found by Jerre Levy in her doctoral studies showed that the mode of processing used by the right brain is rapid, complex, whole-pattern, spatial, and perceptual—processing that is not only different from but comparable in complexity to the left brain's verbal, analytic mode. Additionally, Levy found indications that the two modes of processing tend to interfere with each other, preventing maximal performance; and she suggested that this may be a rationale for the evolutionary development of asymmetry in the human brain—as a means of keeping the two different modes of processing in two different hemispheres.

"The data indicate that the mute, minor hemisphere is specialized for Gestalt perception, being primarily a synthesist in dealing with information input. The speaking, major hemisphere, in contrast, seems to operate in a more logical, analytic, computer-like fashion. Its language is inadequate for the rapid complex syntheses achieved by the minor hemisphere."

—Jerre Levy and
R. W. Sperry
1968

Based on the evidence of the split-brain studies, the view came gradually that both hemispheres use high human-level cognitive modes which, though different, involve thinking, reasoning, and complex mental functioning. Over the past decade, since the first statement in 1968 by Levy and Sperry, scientists have found extensive supporting evidence for this view, not only in brain-injured patients but also in individuals with normal, intact brains.

A few examples of the specially designed tests devised for use with the split-brain patients might illustrate the separate reality perceived by each hemisphere and the special modes of processing employed. In one test, two different pictures were flashed for an instant on a screen, with a split-brain patient's eyes fixed on a midpoint so that scanning both images was prevented. Each hemisphere, then, received different pictures. A picture of a spoon on the left side of the screen went to the right brain; a picture of a knife on the right side of the screen went to the verbal left brain, as in Figure 3-4. When questioned, the patient gave different responses. If asked to name what had been flashed on the screen, the confidently articulate left hemisphere caused the patient to say, "knife." Then the patient was asked to reach behind a curtain with his left hand (right hemisphere) and pick out what had been flashed on the screen. The patient then picked out a

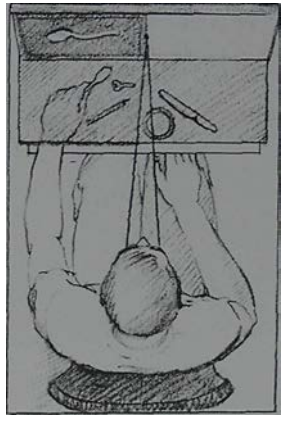


Fig. 3-4. A diagram of the apparatus used to test visual-tactile associations by split-brain patients. Adapted from Michael S. Gazzaniga, "The Split Brain in Man."

spoon from a group of objects that included a spoon and a knife. If the experimenter asked the patient to identify what he held in his hand behind the curtain, the patient might look confused for a moment and then say, "A knife." The right hemisphere, knowing that the answer was wrong but not having sufficient words to correct the articulate left hemisphere, continued the dialogue by causing the patient to mutely shake his head. At that, the verbal left hemisphere wondered aloud, "Why am I shaking my head?"

In another test that demonstrated the right brain to be better at spatial problems, a male patient was given several wooden shapes to arrange to match a certain design. His attempts with his right hand (left hemisphere) failed again and again. His left hand kept trying to help. The right hand would knock the left hand away; and finally, the man had to sit on his left hand to keep it away from the puzzle. When the scientists finally suggested that he use both hands, the spatially "smart" left hand had to shove the spatially "dumb" right hand away to keep it from interfering.

As a result of these extraordinary findings over the past fifteen years, we now know that despite our normal feeling that we are one person—a single being—our brains are double, each half with its own way of knowing, its own way of perceiving external reality. In a manner of speaking, each of us has two minds, two consciousnesses, mediated and integrated by the connecting cable of nerve fibers between the hemispheres.

We have learned that the two hemispheres can work together in a number of ways. Sometimes they cooperate with each half contributing its special abilities and taking on the particular part of the task that is suited to its mode of information processing. At other times, the hemispheres can work singly, with one mode more or less "leading," the other more or less "following." And it seems that the hemispheres may also conflict, one half attempting to do what the other half "knows" it can do better. Furthermore, it may be that each hemisphere has a way of keeping knowledge from the other hemisphere. It may be, as the saying goes, that the right hand truly does not know what the left hand is doing.

The double reality of split-brain patients

But what, you might ask, does all this have to do with learning how to draw? Research on brain-hemisphere aspects of visual perception indicates that ability to draw may depend on whether you can access at conscious level the "minor," or subdominant, R-mode. How does this help a person to draw? It appears that the right brain perceives—processes visual information—in a mode suitable for drawing, and that the left-brain mode of functioning may be inappropriate for complex realistic drawing of perceived forms.

Nasrudin was sitting with a friend as dusk fell. "Light a candle," the man said, "because it is dark now. There is one just by your left side." "How can I tell my right from my left in the dark, you fool?" asked the Mulla.

— Indries Shah
The Exploits of the Incomparable Mulla Nasrudin

Language clues

In hindsight, we realize that human beings must have had some sense of the differences between the halves of the brain. Languages worldwide contain numerous words and phrases suggesting that the left side of a person has different characteristics from the right side. These terms indicate not just differences in location but differences in fundamental traits or qualities. For example, if we want to compare unlike ideas, we say, "On the one hand … on the other hand…" "A left-handed compliment," meaning a sly dig, indicates the differing qualities we assign to left and right.

Keep in mind, however, that these phrases generally speak of hands, but because of the crossover connections of hands and hemispheres, the terms can be inferred also to mean the hemispheres that control the hands. Therefore, the examples of familiar terms in the next section refer specifically to the left and right hands but in reality also refer inferentially to the opposite brain halves—the left hand controlled by the right hemisphere, the right hand by the left hemisphere.

The bias of language and customs

Words and phrases concerning concepts of left and right permeate our language and thinking. The right hand (meaning also the left hemisphere) is strongly connected with what is good, just, moral, and proper. The left hand (therefore the right hemisphere)

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 Poincare 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	nonlineal
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*

Yin	*Yang*
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 Poincare 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. Poincare 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 Palinuris, 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.

"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

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.

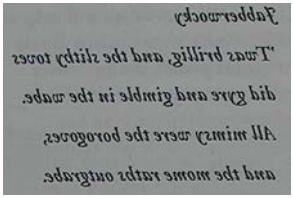
First, classifying people as strictly left-handed or right-handed is not quite accurate. People range from being completely left-handed or completely right-handed to being completely ambidextrous—that is, able to do many things with either hand, without a decided preference. Most of us fall somewhere 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-

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:



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 tooking-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. ScientistJerre 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.

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.

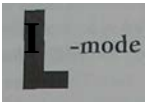
Aztecs in early Mexico used the left hand for medicine for kidney trouble, the right when curing the liver.

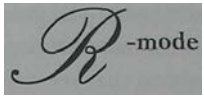
The Incas of ancient Peru considered left-handedness a sign of good fortune.

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

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

A comparison of left-mode and right-mode characteristics





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

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?

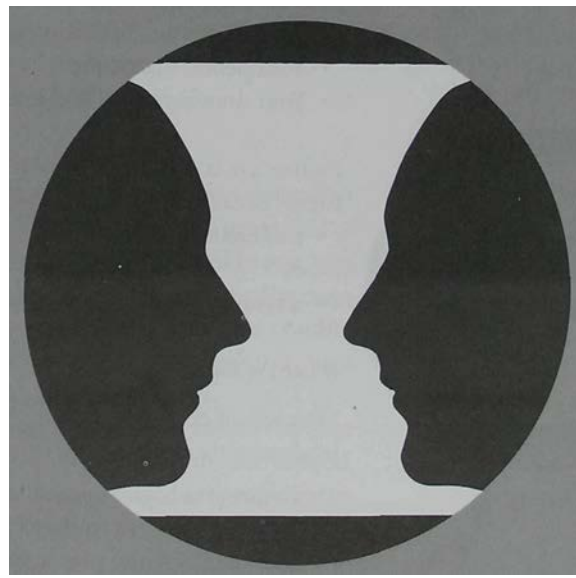
Through studies with animals, split-brain patients, and individuals with intact brains, scientists believe that the control question may be decided mainly in two ways. One way is speed: Which hemisphere gets to the job the quickest? A second way is motivation: Which hemisphere cares most or likes the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

Crossing Over: Experiencing the Shift from Left to Right



Vases and faces: An exercise for the double brain

A puzzle: "If one picture is worth a thousand words, can a thousand words explicate one picture?"

— Michael Stephan
A Transformational Theory of Aesthetics, London: Routledge, 1990

The exercises that follow are specifically designed to help you understand the shift from dominant left-hemisphere mode to subdominant R-mode. I could go on describing the process over and over in words, but only you can experience for yourself this cognitive shift, this slight change in subjective state. As Fats Waller once said, "If you gotta ask what jazz is, you ain't never gonna know." So it is with R-mode state: You must experience the L- to R-mode shift, observe the R-mode state, and in this way come to know it. As a first step, the exercise below is designed to cause conflict between the two modes.

Following is a quick exercise designed to induce mental conflict.

What you'll need:

- Drawing paper
- Your #2 writing pencil
- Your pencil sharpener
- Your drawing board and masking tape

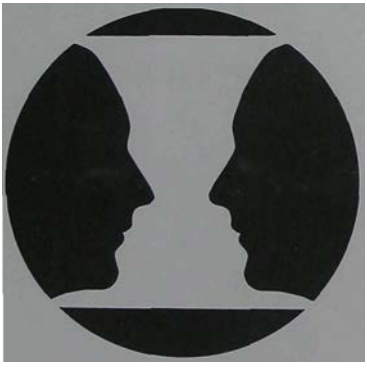


Fig. 4-1.

Figure 4-1 is a famous optical-illusion drawing, called "Vase/Faces" because it can be seen as either:

- two facing profiles
  or
- a symmetrical vase in the center.

What you'll do:

Your job, of course, is to complete the second profile, which will inadvertently complete the symmetrical vase in the center.

Before you begin: Read all the directions for the exercise.

1. Copy the pattern (either Figure 4-2 or 4-3). If you are right-handed, copy the profile on the left side of the paper, facing toward the center. If you are left-handed, draw the profile on the right side, facing toward the center. Examples are shown of both the right-handed and left-handed drawings. Make up

your own version of the profile if you wish.

2. Next, draw horizontal lines at the top and bottom of your profile, forming top and bottom of the vase (Figures 4-2 and 4-3).
3. Now, redraw the profile on your "Vase/Faces" pattern. Just take your pencil and go over the lines, naming the parts as you go, like this: "Forehead … nose … upper lip … lower lip … chin . . . neck." You might even do that a second time, redrawing one more time and really thinking to yourself what those terms mean.
4. Then, go to the other side and start to draw the missing profile that will complete the symmetrical vase.
5. When you get to somewhere around the forehead or nose, you may begin perhaps to experience some confusion or conflict. Observe this as it happens.
6. The purpose of this exercise is for you to self-observe: "How do I solve the problem?"

Begin the exercise now. It should take you about five or six minutes.

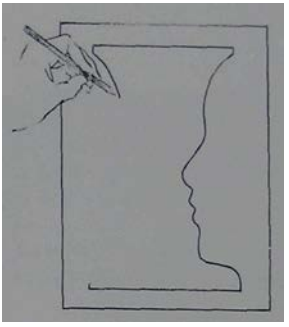


Fig. 4-2. For left-handers.

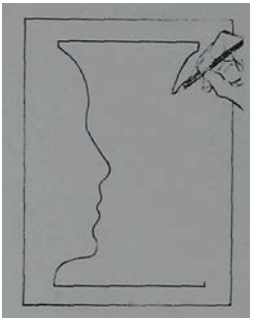


Fig. 4-3. For right-handers.

Why you did this exercise:

Nearly all of my students experience some confusion or conflict while doing this exercise. A few people experience a great deal of conflict, even a moment of paralysis. If this happened to you, you may have come to a point where you needed to change direction in the drawing, but didn't know which way to go. The conflict may have been so great that you could not make your hand move the pencil to the right or the left.

That is the purpose of the exercise: to create conflict so that each person can experience in their own minds the mental "crunch" that can occur when instructions are inappropriate to the task at hand. I believe that the conflict can be explained as follows:

I gave you instructions that strongly "plugged in" the verbal system in the brain. Remember that I insisted that you name each

part of the profile and I said, "Now, really think what those terms mean."

Then, I gave you a task (to complete the second profile and, simultaneously, the vase) that can only be done by shifting to the visual, spatial mode of the brain. This is the part of the brain that can perceive and nonverbally assess relationship of sizes, curves, angles, and shapes.

The difficulty of making that mental shift causes a feeling of conflict and confusion—and even a momentary mental paralysis.

You may have found a way to solve the problem, thereby enabling yourself to complete the second profile and therefore the symmetrical vase.

How did you solve it?

- By deciding not to think of the names of the features?
- By shifting your focus from the face-shapes to the vase-shapes?
- By using a grid (drawing vertical and horizontal lines to help you see relationships)? Or perhaps by marking points where the outermost and innermost curves occurred?
- By drawing from the bottom up rather than from the top down?
- By deciding that you didn't care whether the vase was symmetrical or not and drawing any old memorized profile just to finish with the exercise? (With this last decision, the verbal system "won" and the visual system "lost.")

By the way, I must mention that the eraser is just as important a tool for drawing as the pencil. I'm not exactly sure where the notion "erasing is bad" came from. The eraser allows you to correct your drawings. My students certainly see me erasing when I do demonstration drawings in our workshops.

Let me ask you a few more questions. Did you use your eraser to "fix up" your drawing? If so, did you feel guilty? If so, why? (The verbal system has a set of memorized rules, one of which may be, "You can't use an eraser unless the teacher says it's okay.") The visual system, which is largely without language, just keeps looking for ways to solve the problem according to another kind of logic—visual logic.

To sum up, the point of the seemingly simple "Vase/Faces" exercise is this:

In order to draw a perceived object or person—something that you see with your eyes—you must make a mental shift to a

brain-mode that is specialized for this visual, perceptual task.

The difficulty of making this shift from verbal to visual mode often causes conflict. Didn't you feel it? To reduce the discomfort of the conflict, you stopped (do you remember feeling stopped short?) and made a new start. That's what you were doing when you gave yourself instructions—that is, gave your brain instructions—to "shift gears," or "change strategy," or "don't do this; do that," or whatever terms you may have used to cause a cognitive shift.

There are numerous solutions to the mental "crunch" of the "Vase/Faces" Exercise. Perhaps you found a unique or unusual solution. To capture your personal solution in words, you might want to write down what happened on the back of your drawing.

Thomas Gladwin, an anthropologist, contrasted the ways that a European and a native Trukese sailor navigated small boats between tiny islands in the vast Pacific Ocean.

Before setting sail, the European begins with a plan that can be written in terms of directions, degrees of longitude and latitude, estimated time of arrival at separate points on the journey. Once the plan is conceived and completed, the sailor has only to carry out each step consecutively, one after another, to be assured of arriving on time at the planned destination. The sailor uses all available tools, such as a compass, a sextant, a map, etc., and if asked, can describe exactly how he got where he was going.
The European navigator uses the left-hemisphere mode.

In contrast, the native Trukese sailor starts his voyage by *imaging the position* of his destination *relative to the position* of other islands. As he sails along, he constantly adjusts his direction according to his awareness of his position *thus far.* His decisions are improvised continually by checking relative positions of landmarks, sun, wind direction, etc. He navigates with reference to where he started, where he is going, and the space between his destination and the point *where he is at the moment.* If asked how he navigates so well without instruments or a written plan, he cannot possibly put it into words. This is not because the Trukese are unaccustomed to describing things in words, but rather because the process is too complex and fluid to be put into words.
The Trukese navigator uses the right-hemisphere mode.

—J. A. Paredes and M.J. Hepburn
"The Split-Brain and the Culture-Cognition Paradox," 1976

Charles Tart, professor of psychology at the University of California, Davis, states: "We begin with a concept of some kind of basic *awareness*, some kind of basic ability to 'know' or 'sense' or 'cognize' or 'recognize' that something is happening. This is a fundamental theoretical and experiential given. We do not know scientifically what the ultimate nature of awareness is, but it is our starting point."

— Charles T. Tart
Alternate States of Consciousness, 1975

Navigating a drawing in right-hemisphere mode

When you did your drawing of the Vase/Faces, you drew the first profile in the left-hemisphere mode, like the European navigator, taking one part at a time and naming the parts one by one. The second profile was drawn in the right-hemisphere mode. Like the navigator from the South Sea Island of Truk, you constantly scanned to adjust the direction of the line. You probably found that naming the parts such as forehead, nose, or mouth seemed to confuse you. It was better not to think of the drawing as a face. It was easier to use the shape of the space between the two profiles as your guide. Stated differently, it was easiest not to think at all—that is, in words. In right-hemisphere-mode drawing, the mode of the artist, if you do use words to think, ask yourself only such things as:

"Where does that curve start?"

"How deep is that curve?"

"What is that angle relative to the edge of the paper?"

"How long is that line relative to the one I've just drawn?"

"Where is that point as I scan across to the other side—where is that point relative to the distance from the top (or bottom) edge of the paper?"

These are R-mode questions: spatial, relational, and comparative. Notice that no parts are named. No statements are made, no conclusions drawn, such as, "The chin must come out as far as the nose," or "Noses are curved."

A brief review: What is learned in "learning to draw"?

Realistic drawing of a perceived image requires the visual mode of the brain, most often mainly located in the right hemisphere. This visual mode of thinking is fundamentally different from the brain's verbal system—the one we largely rely on nearly all of our waking hours.

For most tasks, the two modes are combined. Drawing a perceived object or person may be one of the few tasks that requires mainly one mode: the visual mode largely unassisted by the ver-

bal mode. There are other examples. Athletes and dancers, for instance, seem to perform best by quieting the verbal system during performances. Moreover, a person who needs to shift in the other direction, from visual to verbal mode, can also experience conflict. A surgeon once told me that while operating on a patient (mainly a visual task, once a surgeon has acquired the knowledge and experience needed) he would find himself unable to name the instruments. He would hear himself saying to an attendant, "Give me the... the... you know, the... thingamajig!"

Learning to draw, therefore, turns out not to be "learning to draw." Paradoxically, learning to draw means learning to access at will that system in the brain that is the appropriate one for drawing. Putting it another way, accessing the visual mode of the brain—the appropriate mode for drawings—causes you to see in the special way an artist sees. The artist's way of seeing is different from ordinary seeing and requires an ability to make mental shifts at conscious level. Put another way and perhaps more accurately, the artist is able to set up conditions that cause a cognitive shift to "happen." That is what a person trained in drawing does, and that is what you are about to learn.

Again, this ability to see things differently has many uses in life aside from drawing—not the least of which is creative problem solving.

Keeping the "Vase/Faces" lesson in mind, then, try the next exercise, one that I designed to reduce conflict between the two brain-modes. The purpose of this exercise is just the reverse of the previous one.

"The object of painting a picture is not to make a picture—however unreasonable that may sound ... The object, which is back of every true work of art, is the attainment of a *state of being* [Henri's emphasis], a state of high functioning, a more than ordinary moment of existence. [The picture] is but a by-product of the state, a trace, the footprint of the state."

From *The Art Spirit* by American artist and teacher Robert Henri, B. Lippincott Company, 1923.

Upside-down drawing: Making the shift to R-mode

Familiar things do not look the same when they are upside down. We automatically assign a top, a bottom, and sides to the things we perceive, and we expect to see things oriented in the usual way—that is, right side up. For, in upright orientation, we can recognize familiar things, name them, and categorize them by matching what we see with our stored memories and concepts.

When an image is upside down, the visual clues don't match.

The message is strange, and the brain becomes confused. We see the shapes and the areas of light and shadow. We don't particularly object to looking at upside-down pictures unless we are called on to name the image. Then the task becomes exasperating.

Seen upside down, even well-known faces are difficult to recognize and name. For example, the photograph in Figure 4-4 is of a famous person. Do you recognize who it is?

You may have had to turn the photograph right side up to see that it is Albert Einstein, the famous scientist. Even after you

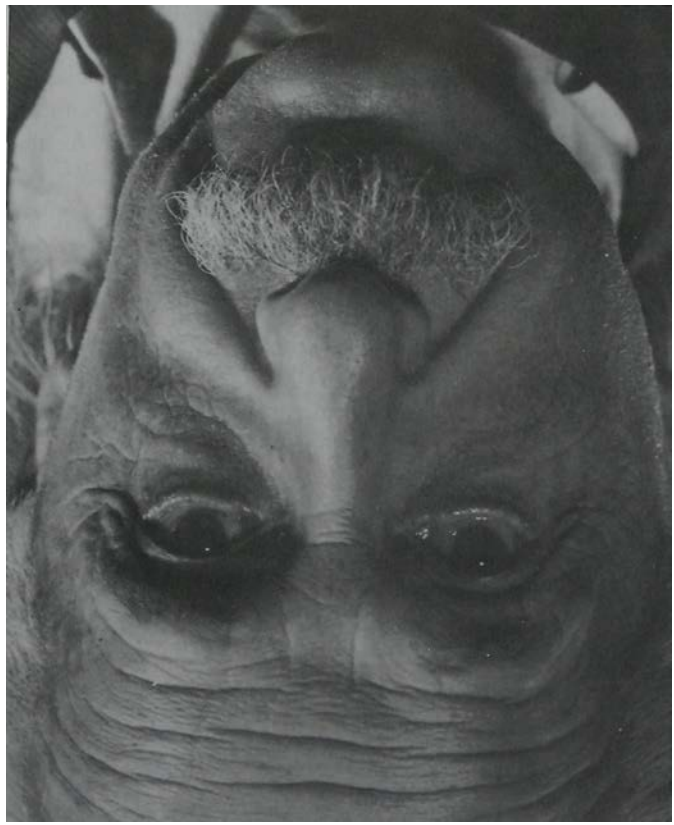


Fig. 4-4. Photograph by Philippe Halsman.

know who the person is, the upside-down image probably continues to look strange.

Inverted orientation causes recognition problems with other images (see Figure 4-5). Your own handwriting, turned upside down, is probably difficult for you to figure out, although you've been reading it for years. To test this, find an old shopping list or letter in your handwriting and try to read it upside down.

A complex drawing, such as the one shown upside down in the Tiepolo drawing, Figure 4-6, is almost indecipherable. The (left) mind just gives up on it.

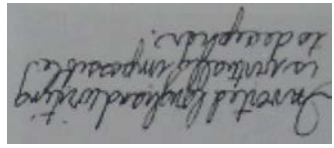


Fig. 4-5. In copying signatures, forgers turn the originals upside down to see the exact shapes of the letters more clearly—to see, in fact, in the artist's mode.

Fig. 4-6. Giovanni Battista Tiepolo (1696-1770), *The Death of Seneca.* Courtesy of The Art Institute of Chicago, Joseph and Helen Regenstein Collection.

Upside-down drawing

An exercise that reduces mental conflict

We shall use this gap in the abilities of the left hemisphere to allow R-mode to have a chance to take over for a while.

Figure 4-7 is a reproduction of a line drawing by Picasso of the composer Igor Stravinsky. The image is upside down. You will be copying the upside-down image. Your drawing, therefore, will be done also upside down. In other words, you will copy the Picasso drawing just as you see it. See Figures 4-8 and 4-9.

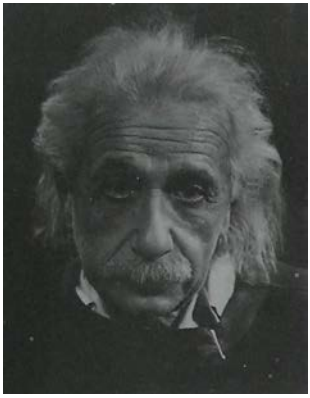
What you'll need:

- The reproduction of the Picasso drawing, Fig. 4-7, p. 58.
- Your #2 writing pencil, sharpened.
- Your drawing board and masking tape.
- Forty minutes to an hour of uninterrupted time.

What you'll do:

Before you begin: Read all of the following instructions.

1. Play music if you like. As you shift into R-mode, you may find that the music fades out. Finish the drawing in one sitting, allowing yourself at least forty minutes—more if possible. And more important, do not turn the drawing right side up until you have finished. Turning the drawing would cause a shift back to L-mode, which we want to avoid while you are



Photograph by Philippe Haisman, 1947. © Yvonne Haisman, 1989. This is the full photograph shown upside down on the page 56. We are indebted to Yvonne Haisman for allowing this unorthodox presentation of Philippe Halsman's famous image of Einstein.

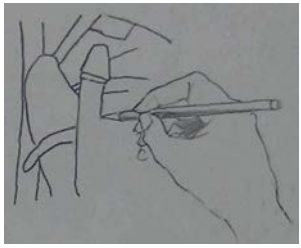
learning to experience the focused R-mode state of awareness.

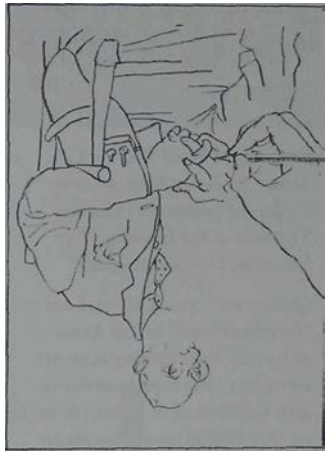
2. You may start anywhere you wish—bottom, either side, or the top. Most people tend to start at the top. Try not to figure out what you are looking at in the upside-down image. It is better not to know. Simply start copying the lines. But remember: don't turn the drawing right side up!

Fig. 4-7. Pablo Picasso (1881-1973), *Portrait of Igor Stravinsky.* Paris, May 21, 1920 (dated). Privately owned.

3. I recommend that you not try to draw the entire outline of the form and then "fill in" the parts. The reason is that if you make any small error in the outline, the parts inside won't fit. One of the great joys of drawing is the discovery of how the parts fit together. Therefore, I recommend that you move from line to adjacent line, space to adjacent shape, working your way through the drawing, fitting the parts together as you go.
4. If you talk to yourself at all, use only the language of vision, such as: "This line bends this way," or, "That shape has a curve there," or "Compared to the edge of the paper (vertical or horizontal), this line angles like that," and so on. What you do not want to do is to name the parts.
5. When you come to parts that seem to force their names on you—the H-A-N-D-S and the F-A-C-E—try to focus on these parts just as shapes. You might even cover up with one hand or finger all but the specific line you are drawing and then uncover each adjacent line. Alternatively, you might shift to another part of the drawing.
6. At some point, the drawing may begin to seem like an interesting, even fascinating, puzzle. When this happens, you will be "really drawing," meaning that you have successfully shifted to R-mode and you are seeing clearly. This state is easily broken. For example, if someone were to come into the room and ask, "How are you doing?" your verbal system would be reactivated and your focus and concentration would be over.
7. You may even want to cover most of the reproduced drawing with another piece of paper, slowly uncovering new areas as you work your way down through the drawing. A note of caution, however: Some of my students find this ploy helpful, while some find it distracting and unhelpful.
8. Remember that everything you need to know in order to draw the image is right in front of your eyes. All of the information is right there, making it easy for you. Don't make it complicated. It really is as simple as that.

Begin your Upside-Down Drawing now.





Figs. 4-8,4-9. Inverted drawing. Forcing the cognitive shift from the dominant left-hemisphere mode to the subdominant right-hemisphere mode.

Fig. 4-10. "I Want You for U S. Army" by James Montgomery Flagg, 1917 poster. Permission: Trustees of the Imperial War Museum, London, England.

Uncle Sam's arm and hand are "foreshortened" in this Army poster. Foreshortening is an art term. It means that, in order to give the illusion of forms advancing or receding in space, the forms must be drawn just as they appear in that position, not depicting what we know about their actual length. Learning to "foreshorten" is often difficult for beginners in drawing.

After you have finished:

Turn both of the drawings—the reproduction in the book and your copy—right side up. I can confidently predict that you will be pleased with your drawing, especially if you have thought in the past that you would never be able to draw.

I can also confidently predict that the most "difficult" parts, the "foreshortened" areas, are beautifully drawn, creating a spatial illusion.

Yet, see what you have accomplished, drawing upside down. If you used Picasso's drawing of Igor Stravinsky seated in a chair, you drew the crossed legs beautifully in foreshortened view. For most of my students, this is the finest part of their drawing, despite the foreshortening. How could they draw this "difficult" part so well? Because they didn't know what they were drawing! They simply drew what they saw, just as they saw it—one of the most important keys to drawing well. The same applies to the foreshortened horse in the German drawing, Figure 4-13.

A logical box for L-mode

Figure 4-11 and Figure 4-12 show two drawings by the same university student. This student had misunderstood my instructions to the class and did the drawing right side up. When he came to class the next day, he showed me his drawing and said, "I misunderstood. I just drew it the regular way." I asked him to do another drawing, this time upside down. He did, and Fig. 4-12 was the result.

It goes against common sense that the upside-down drawing

Fig. 4-11; near right: The Picasso drawing mistakenly copied right side up by a university student.

Fig. 4-12; far right: The Picasso drawing copied upside down the next day by the same student.

is so far superior to the drawing done right side up. The student himself was astonished.

This puzzle puts L-mode into a logical box: how to account for this sudden ability to draw well, when the verbal mode has been eased out of the task. The left brain, which admires a job well done, must now consider the possibility that the disdained right brain is good at drawing

For reasons that are still unclear, the verbal system immediately rejects the task of "reading" and naming upside-down images. L-mode seems to say, in effect, "I don't do upside down. It's too hard to name things seen this way, and, besides, the world isn't upside down. Why should I bother with such stuff?"

Well, that's just what we want! On the other hand, the visual system seems not to care. Right side up, upside down, it's all interesting, perhaps even more interesting upside down because R-mode is free of interference from its verbal partner, which is often in a "rush to judgment" or, at least, a rush to recognize and name.

"Our normal waking consciousness, rational consciousness, as we call it, is but one special type of consciousness, whilst all about it, parted from it by the filmiest of screens, there lie potential forms of consciousness entirely different. We may go through life without suspecting their existence; but apply the requisite stimulus, and at a touch they are there in all their completeness, definite types of mentality which probably somewhere have their field of application and adaptation."

— William James
The Varieties of Religious Experience, 1902

Why you did this exercise:

The reason you did this exercise, therefore, is to experience escaping the clash of conflicting modes—the kind of conflict and even mental paralysis that the "Vase/Faces" exercise caused. When L-mode drops out voluntarily, conflict is avoided and R-mode quickly takes up the task that is appropriate for it: drawing a perceived image.

L-mode is the "right-handed," left-hemisphere mode. The L is foursquare, upright, sensible, direct, true, hard-edged, unfanciful, forceful.

R-mode is the "left-handed," right-hemisphere mode. The R is curvy, flexible, more playful in its unexpected twists and turns, more complex, diagonal, fanciful.

Getting to know the L->R shift

Two important points of progress emerge from the upside-down exercise. The first is your conscious recall of how you felt after you made the L->R cognitive shift. The quality of the R-mode state of consciousness is different from the L-mode. One can detect those differences and begin to recognize when the cognitive shift has occurred. Oddly, the moment of shifting between states of consciousness always remains out of awareness. For example, one can be aware of being alert and then of being in a

"I have supposed a Human Being to be capable of various physical states, and varying degrees of consciousness, as follows:

"(a) the ordinary state, with no consciousness of the presence of Fairies;

"(b) the 'eerie' state, in which, while conscious of actual surroundings, he is *also* conscious of the presence of Fairies;

"(c) a form of trance, in which, while *un*conscious of actual surrounding, and apparently asleep, he (i.e., his immaterial essence) migrates to other scenes, in the actual world, or in Fairyland, and is conscious of the presence of Fairies."

— Lewis Carroll
Preface to *Sylvie and Bruno*

daydream, but the moment of shifting between the two states remains elusive. Similarly, the moment of the cognitive shift from L->R remains out of awareness, but once you have made the shift, the difference in the two states is accessible to knowing. This knowing will help to bring the shift under conscious control—a main goal of these lessons.

The second insight gained from the exercise is your awareness that shifting to the R-mode enables you to see in the way a trained artist sees, and therefore to draw what you perceive.

Now, it's obvious that we can't always be turning things upside down. Your models are not going to stand on their heads for you, nor is the landscape going to turn itself upside down or inside out. Our goal, then, is to teach you how to make the cognitive shift when perceiving things in their normal right-side-up positions. You will learn the artist's "gambit": to direct your attention toward visual information that L-mode cannot or will not process. In other words, you will always try to present your brain with a task the language system will refuse, thus allowing R-mode to use its capability for drawing. Exercises in the coming chapters will show you some ways to do this.

A review of R-mode

It might be helpful to review what R-mode feels like. Think back. You have made the shift several times now—slightly, perhaps, while doing the Vase/Faces drawings and more intensely just now while drawing the "Stravinsky."

In the R-mode state, did you notice that you were somewhat unaware of the passage of time—that the time you spent drawing may have been long or short, but you couldn't have known until you checked it afterward? If there were people near, did you notice that you couldn't listen to what they said—in fact, that you didn't want to hear? You may have heard sounds, but you probably didn't care about figuring out the meaning of what was being said. And were you aware of feeling alert, but relaxed—confident, interested, absorbed in the drawing and clear in your mind?

Most of my students have characterized the R-mode state of

consciousness in these terms, and the terms coincide with my own experience and accounts related to me of artists' experiences. One artist told me, "When I'm really working well, it's like nothing else I've ever experienced. I feel at one with the work: the painter, the painting, it's all one. I feel excited, but calm—exhilarated, but in full control. It's not exactly happiness; it's more like bliss. I think it's what keeps me coming back and back to painting and drawing."

R-mode state is indeed pleasurable, and in that mode you can draw well. But there is an additional advantage: Shifting to R-mode releases you for a time from the verbal, symbolic domination of L-mode, and that's a welcome relief. The pleasure may come from resting the left hemisphere, stopping its chatter, keeping it quiet for a change. This yearning to quiet L-mode may partially explain centuries-old practices such as meditation and self-induced altered states of consciousness achieved through fasting, drugs, chanting, and alcohol. Drawing induces a focused, alert state of consciousness that can last for hours, bringing significant satisfaction.

Before you read further, do at least one or two more drawings upside down. Use either the reproduction in Figure 4-13, or find other line drawings to copy. Each time you draw, try consciously to experience the R-mode shift, so that you become familiar with how it feels to be in that mode.

"I know perfectly well that only in happy instants am I lucky enough to lose myself in my work. The painter-poet feels that his true immutable essence comes from that invisible realm that offers him an image of eternal reality.... I feel that I do not exist in time, but that time exists in me. I can also realize that it is not given to me to solve the mystery of art in an absolute fashion. Nonetheless, I am almost brought to believe that I am about to get my hands on the divine."

— Carlo Carra
"The Quadrant of the Spirit," 1919

Recalling the art of your childhood

In the next chapter we'll review your childhood development as an artist. The developmental sequence of children's art is linked to development changes in the brain. In the early stages, infants' brain hemispheres are not clearly specialized for separate functions. Lateralization—the consolidation of specific functions into one hemisphere or the other—progresses gradually through the childhood years, paralleling the acquisition of language skills and the symbols of childhood art.

Lateralization is usually complete by around age ten, and this coincides with the period of conflict in children's art, when the

This sixteenth-century drawing by an unknown German artist offers a wonderful opportunity to practice upside-down drawing.

Fig. 4-13. Line drawing copy of the German horse and rider.

symbol system seems to override perceptions and to interfere with accurate drawing of those perceptions. One could speculate that conflict arises because children may be using the "wrong" brain mode—L-mode—to accomplish a task best suited for R-mode. Perhaps they simply cannot work out a way to shift to the visual mode. Also, by age ten, language dominates, adding further complication as names and symbols overpower spatial, holistic perceptions.

Reviewing your childhood art is important for several reasons: to look back as an adult at how your set of drawing symbols developed from infancy onward; to reexperience the increasing complexity of your drawing as you approached adolescence; to recall the discrepancy between your perceptions and your drawing skills; to view your childhood drawings with a less critical eye than you were able to manage at the time; and finally, to set your childhood symbol system aside and move on to an adult level of visual expression by using the appropriate brain mode—the right mode—for the task of drawing.