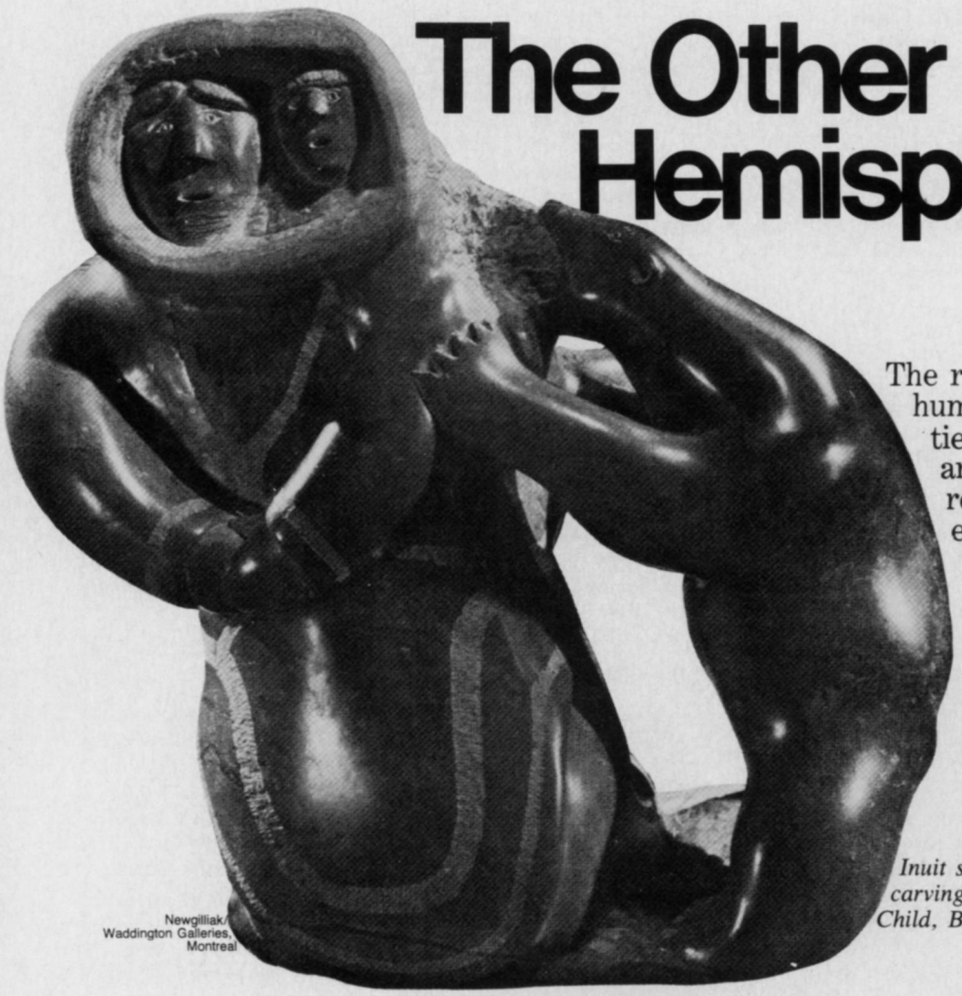
The Other Hemisphere



Newgilliak/ Waddington Galleries, Montreal

Inuit soapstone carving: "Woman, Child, Bear"

The right hemisphere of the human brain has special qualities. Brain specialists, anthropologists and other researchers pool their evidence to delineate them.

BY ROBERT J. TROTTER

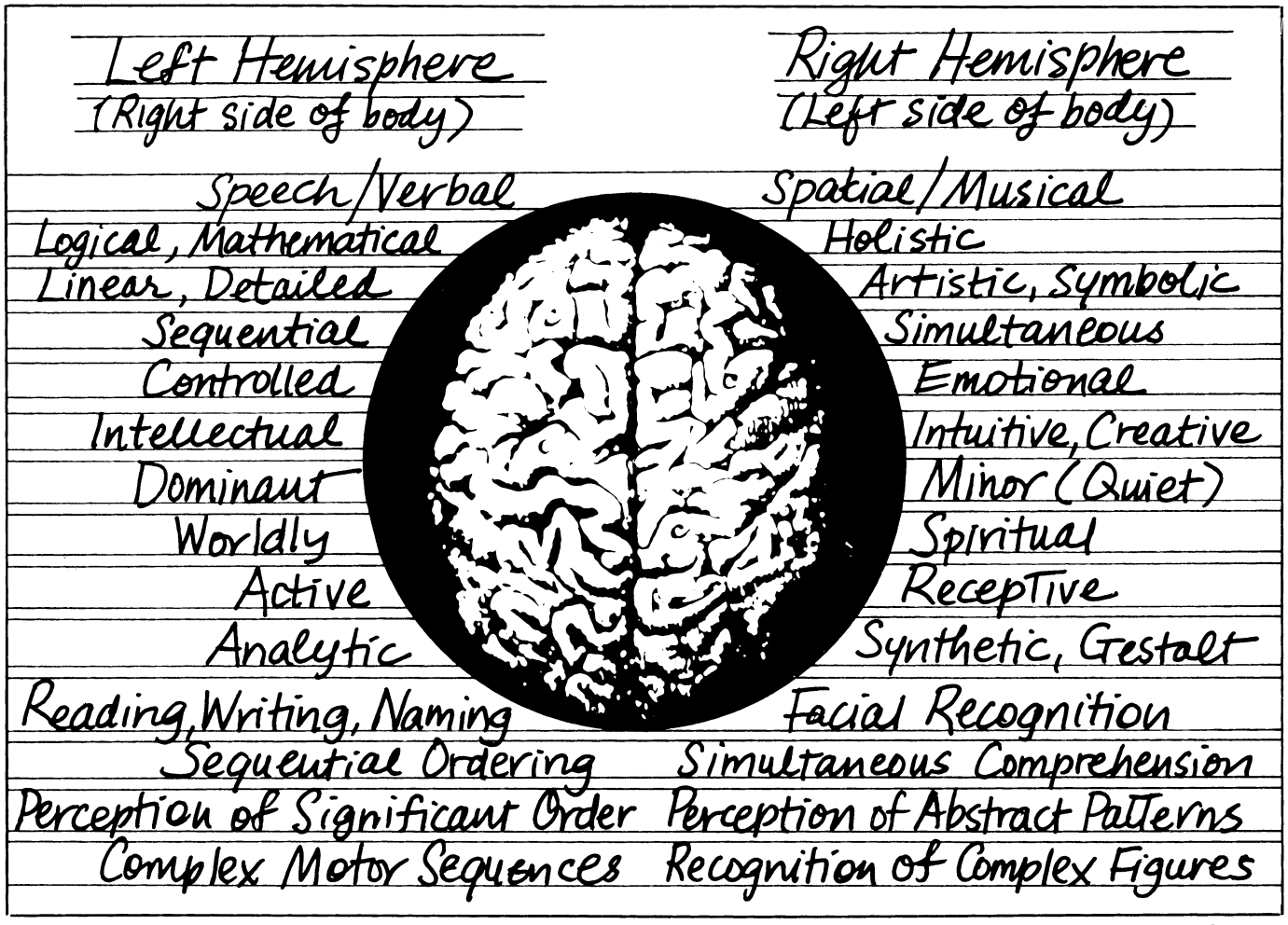
Of all the frontiers science has yet to conquer, of all the mysteries it has yet to unravel, one of the most exciting and possibly the most important is the still uncharted human brain. Rising to meet this challenge are thousands of researchers in a number of diverse fields, each coming at the brain from a slightly different angle. Neuroscientists, brain anatomists, electrophysiologists, biochemists and other specialists in the physical sciences are all probing the brain in attempts to understand what it is and how it works. But investigations of the brain itself do not give the whole picture. Mapping the brain from an entirely different but equally valid perspective are the behavioral scientists who hope to get a better understanding of the human brain by examining not what it is but what it produces—human behavior.

Along these lines, an investigation was conducted last summer among the Inuit or Eskimo people of Baffin Island in northeastern Canada. The project, directed by anthropologist Solomon H. Katz of the University Museum of the University of Pennsylvania, dealt specifically with one of the most fascinating and fastest growing areas of brain research, cerebral asymmetry or hemispheric dominance. The researchers (including another anthropologist, a psychologist and a psychiatrist) studied the environment, lifestyle, socialization processes, art objects, eye movements and hand use of the Inuits and found what appear to be important correlations between all of these and the activity of the brain's right hemisphere.

To the naked eye, the halves of the human brain look almost like mirror images of each other, but for more than 100 years it has been known that the right and left hemispheres function differently. In 1861, Pierre Paul Broca, physical anthropologist and a founder of modern brain surgery, localized the center of articulate speech in an area of the left frontal cortex now known as Broca's area. In 1874, Carl Wernicke discovered a sensory speech center in the left hemisphere. It is concerned with the comprehension of language and is now known as Wernicke's area. Lesions in these two portions of the left hemisphere were found to cause various types of aphasia, the loss or impairment of the ability to use words as symbols or ideas.

Speech is only one ability that the hemispheres do not have in common. People who have suffered neural damage to one or the other hemisphere show a number of behavioral differences that have helped researchers delineate functional areas of the brain. An accident involving the left hemisphere can impair speech or produce aphasia. Damage exclusively to the right hemisphere does not usually disrupt linguistic abilities but can lower performance in spatial tasks, simple musical abilities, recognition of familiar objects and faces and bodily self awareness.

Since these discoveries were made, and especially in the past 20 years, the whole field of research into the differing functions of the hemispheres has blossomed. It was in 1953 that Roger W. Sperry began his far-reaching "split-brain" research. Working with Ronald E. Meyers at the California Institute of Technology, Sperry performed split-brain operations on cats. The corpus callosum, the bundle of nerve fibers that connects the hemispheres, was surgically severed, and the sensory inputs from the eyes were rearranged so that each eye fed information to only one hemisphere (instead of to both as is normally the case). After recovery from surgery, the animals were taught to solve various visual problems with one eye (and hemisphere) or the other. With the left eye blindfolded, the cat learned with its right eye and hemisphere only. When retested with the blindfold switched to the other eye, the cat showed no signs of having learned. After the corpus callosum was severed, the left hemisphere did not know what the



Clinical and experimental evidence along with anthropological data are outlining the separate functions of the hemispheres.

right was learning and vice versa.

These split-brain experiments showed that the hemispheres of the brain can function independently when surgically separated. Once this was demonstrated, it became possible to use the split-brain technique to investigate various aspects of cerebral organization. But cats don't talk, and true cerebral asymmetry is not thought to exist in animals (though recent evidence suggests the possibility of hemispheric specialization in some monkeys and songbirds). It was not until the split-brain procedure was used on humans that it became possible to be more exact in descriptions of the differing functions of the right and left hemispheres of the human brain.

In the intact brain, constant communication must be maintained between the hemispheres because each side controls only one half of the body, the opposite half. If the left hemisphere decides to take a walk, this decision must be signaled not only to the right side of the body but to the right hemisphere—which in turn activates the left side of the body and produces coordinated walking. The connection between the hemispheres is made through the corpus callosum, but this arrangement does not always work to the brain's advantage. An epileptic seizure originating in one hemisphere, for instance, is communicated to the opposite side of the brain (and then back and forth and back and forth), making the seizure much more severe. In some of the worst of these cases, the split-brain operation has been used to contain the epileptic activity to only one hemisphere.

It is these split-brain patients who have added greatly to our growing knowledge of the specific functions of the hemispheres. Sperry and others have reported that the left hemisphere is involved in logical, analytical, linear and sequential (especially time-bound) thought processes and specifically mathematical and linguistic abilities. The right hemisphere is involved in spatial relations, musical (tonal qualities), artistic, simultaneous (not constrained by time) and holistic thought processes.

Brain damage and surgical techniques have been important in mapping the brain, but there are more subtle approaches. Handedness and eye movements have been found to be fairly reliable signs of hemispheric activation. Since the brain seems to have two "minds" that can operate independently and differently, it has been assumed that one hemisphere must be dominant. Depending on the activity involved, one hemisphere or the other must take the lead and maintain control in order to ensure coordination. Because most people are right handed (left brained), and because the speech centers are almost always located in the left hemisphere, that hemisphere has usually been considered "dominant" while the right hemisphere has been called "minor" or "quiet." (Approximately 10 percent of all people are left handed. About half of these are thought to be truly biologically left handed. That is, their speech centers are located in the right hemisphere.)

But the left hemisphere does not always control, and there appear to be degrees of dominance. The amount of right hemisphere activation seems to vary from individual to individual. This is where lateral eye movement (LEM) comes in. When asked a question, people will often glance slightly to the right or to the left before answering. The direction of this initial gaze is thought to be an indication of hemispheric activity. Investigators have found that right LEM's (left hemisphere) are usually associated with verbal and sequential processes while left LEM's (right hemisphere) are usually related to spatial tasks. Recent research has also linked the right hemisphere with emotional processes (SN: 10/18/75, p. 244), and there are indications that the right hemisphere may be involved in such things as creativity and intuition. Meditation, hypnosis and drug use (alcohol,

Katz uses videotape to record the eye movements and hand use of Inuit carvers at work. Left hand (right hemisphere) positions sculpture while detailed work is done with right hand.

Katz

marijuana and cocaine) have also been mentioned in association with right hemisphere activity. It has been suggested, for instance, that some types of drug use may be related to attempts to temporarily free the right hemisphere from the left's dominance in order to produce states of consciousness associated with the right hemisphere. "Spaced out" is a term that applies. And in typical right hemisphere fashion, it offers an integrated impression rather than an analytical description of a state of mind.

It seems likely, says Katz, "that, depending on the activity, normally the brain selectively uses one or the other hemisphere more or less during the performance of various motor activities. In a sense, while we are carrying out one activity, we may be selectively screening out another—perhaps as a child who when spoken to in the midst of daydreaming hears the words but does not know what has been said. Perhaps only in unusual circumstances do we break through to use both hemispherical modes in focused, coordinated fashion, as in a flash of insight, as when Archimedes said 'Eureka!' When this occurs, there is certainly a great deal of exhilaration, a new kind of high point—an 'epiphany,' as James Joyce once called it."

Another line of evidence (still somewhat circumstantial) has to do with patterns of human cognition as seen in different societies. It may be possible, says Katz, to carry out cross-cultural studies of practices that reflect upon the theme of asymmetries in cerebral function. All we have to do, he explains, is determine if various societies have information in their belief systems about the kinds of behaviors expected to be associated with left and right hemispheric functions. Katz has drawn up a list of such behaviors based on the anthropological literature (see ZYGON, vol. 10, no. 1, 1975, a publication of the University of Chicago). In general, he found the left hand and side of the body (right hemisphere) to be associated with the symbolic, ritualistic, mystical, mythical, omnipotent, transcendental, supernatural, evil, profane, foreign and alien. The right hand is typically associated with social order, politics, organization, social system, morality, goodness, sacred, explicitly verbal, mathematical and ordered.

Foulkes

Katz admits that such a list of behaviors related to one hemisphere or the other is only intuitive at present but suggests that anthropological studies will at least produce hypotheses for testing by neuropsychologists. And with that as background, he and his colleagues set out to study cerebral asymmetry among the Inuits in Frobisher Bay and Lake Harbor. (The research was supported by William and Jane Hitchcock of New York.)

If variations in cognitive style emphasizing one kind of thinking over another are possible, says Katz, one of the most likely groups manifesting orientation to right hemispheric functions would be the Inuit Eskimos. They are known for their unusual gestalt (integrated) abilities, such as drawing accurate maps of their territories. They seem to have a sort of symbiotic feeling of oneness with their environment and have traditionally depended on their well-documented ability to find their way out of the most incredible circumstances. Such abilities would probably be highly adaptive in an environment like the Arctic, which demands a high degree of visuospatial ability for survival. In short, says Katz, it would appear that these right hemisphere functions would be more highly developed in Eskimos than in modern urban populations.

The Eskimo language also reflects a high degree of spatial, right hemispheric orientation. Linguistic studies rate it as being the most synthetic of languages. American English is at the other end of the same scale and is rated as the most analytic (left hemisphere).

The Inuit people are also known for their soapstone and whalebone sculptures, wood cuts, lithographs and tapestries. This artwork has been described as "voluptuous, symbiotic and timeless in character," Figures on tapestries and in lithographs are often seen floating helter-skelter without apparent linear or three-dimensional analytic orientation. This art (especially the sculpture) not only provides additional evidence for the Inuit's spatial abilities but also affords researchers a unique opportunity to observe people carrying out work that demands tremendous spatial skills. "Hence," says Katz, "by observing and recording [videotaping] how the stone carvers use their hands and eyes in carrying out their work, we can determine if the special spatial and synthetic abilities resident in the right hemisphere are playing an important role in the creativity expressed in their carvings."

While the researchers have not finished analyzing all of their records, several clear findings have emerged that are highly suggestive of a specific role for the right hemisphere. Among the Inuit carvers (all of whom were right handed), the left hand cradles the work, moves it into new positions and feels its progress while the right hand precisely carves the details and holds the various carving tools. Even when a tool could be placed down, the left hand carried out the repositioning of the stone in space. Also, as predicted, there was a striking preponderance of holding the stone in the left visual field (right hemisphere).

These observations suggest hemispheric symmetry or at least a high degree of cooperation between the hemispheres. Katz finds an "almost perfect relationship between the right hand doing the detailed, analytical kinds of activities and the left hand doing all the spatial and touch activities." The Inuit artists produce some phenomenal representations, he says, with the left hand doing some remarkable things.

Specific conclusions from these observations are hard to reach at present, but there are some interesting implications. The Inuit environment, language and certain social behaviors (such as their emphasis on teaching by demonstration rather than by verbal instruction) all seemingly combine to foster right hemi-

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. . . Right Hemisphere

sphere activity which shows up in the Inuit life style and artwork. This suggests that modes of thinking (or hemisphere use) can be taught. It is possible that different cultures channel people into a greater or lesser reliance on one or the other hemisphere. This may eventually be confirmed as the workings of the brain are further elucidated, but even then will it have any practical import?

Several researchers have addressed this question, and as scientists so often do, they seem to be searching for symmetry:

- Robert Hertz, in 1909, in a classic sociological article on the preeminence of the right hand: "If the constraint of a mystical ideal has for centuries been able to make man into a unilateral being, physiologically mutilated, a liberated and farsighted society will strive to develop the energies dormant in our right cerebral hemisphere and to assure by an appropriate training a more harmonious development of the organism."
- Jerome S. Bruner, experimental psychologist at Oxford University: "Since childhood, I have been enchanted by the fact and the symbolism of the right hand and the left—the one the doer, the other the dreamer. The right is order and lawfulness, *le droit.* Its beauties are those of geometry and taut implication. Reaching for knowledge with the right hand is science. Yet to say only that much of science is to overlook one of its excitements, for the great hypotheses are gifts carried in the left."
- Roger W. Sperry, in the National Science Foundation's March/April 1976 MOSAIC (an excellent overview of the current state of brain research): "Our educational system and modern society generally (with its very heavy emphasis on communication and on early training in the three Rs) discriminates against one whole half of the brain. . . . In our present school system, the attention given to the minor hemisphere of the brain is minimal compared with the training lavished on the left or major hemisphere."
- Solomon H. Katz, speaking of right hemispheric thought processes: "Certainly, the absolutely abundant anthropological evidence that supports their manifestations from the intuitive perspective indicates that our implicit knowledge of these phenomena may be as old as humanity itself. But what is different and truly exciting this time is that we can now begin to use the knowledge as a regular part of our *scientific* understanding of the human mind in order to extend further our means of adapting to the world we live in. . . . At last, our newly developing science of humanity can potentially set us free to recognize that there is more to humanity than all of our linear thinking can give us and to realize that human life viewed predominantly from left hemispheric functions is almost as flat as viewing the world through one eye." □