Symmetry: Culture and Science

SPECIAL ISSUE
Symmetry in a Kaleidoscope 2

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Editors:
György Darvas and Dénes Nagy

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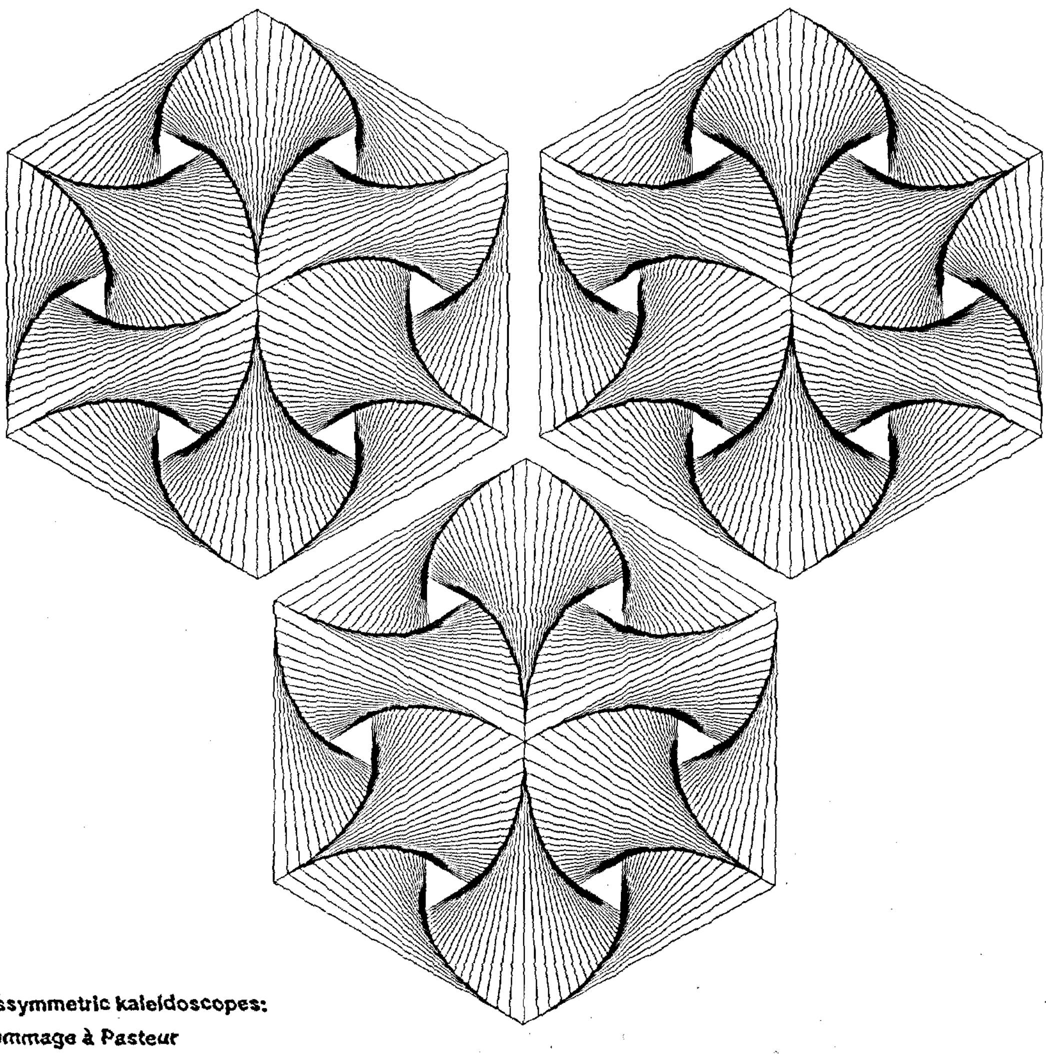

Dissymmetric kaleidoscopes:
Hommage à Pasteur

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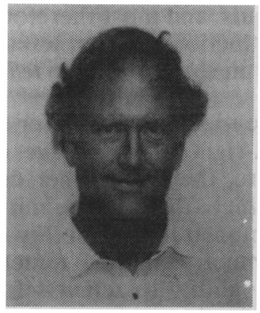
SYMMETRY AND ASYMMETRY IN PSYCHOLOGY

Michael C. Corballis



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QUESTION 1

what is symmetry?

To a psychologist, symmetry generally means *bilateral* symmetry. Animals, including humans, are for the most part symmetrical about the sagittal plane, especially with respect to external bodily shape, and the structure of the brain and central nervous system. This must surely have consequences for their behavior and perhaps even their thought processes.

The simplest of these consequences follows from mechanical considerations: an animal that was *perfectly* bilaterally symmetrical could not tell left from right. In order to show this, it is important first to make clear what it means to be able to "tell left from right". There are two ways in which an animal might demonstrate such an ability. One is to give systematically different outputs to inputs that are left-right mirror-images of one another, with the proviso that the *outputs* are themselves *not* mirror-images of one another. Examples include the Pavlovian dog that salivates when touched on the left side but not when touched on the right side, or the Skinnerian pigeon that pecks a disk when it displays a 45-degree angled line but does not peck when it displays a 135-degree angled line, or the child learning to read who calls the lowercase letter *b* a "bee" and the lowercase letter *d* a "dee". This category of tests is known as *mirror-image discrimination* (Corballis and Beale, 1970).

The second way to demonstrate the ability to tell left from right is to systematically give a rightward output to one input, and a leftward output to a different input. Again, one must include a proviso, which is that the *inputs* are *not* left-right mirror-images of one another. Examples that meet the test include the dog that holds up the right forepaw when a bell rings and the left forepaw when a buzzer sounds, or the soldier who turns right on the command "Right turn!" and left on the command "Left turn!", or the child who correctly writes a *b* when told "bee" and a *d* when told "dee". This category of tests has been called *left-right response differentiation* (Corballis and Beale, 1970).

In mirror-image discrimination, the inputs are left-right mirror-images but the outputs are not, so that the animal must *decode* the left-right aspect, or parity, of the inputs in order to give the correct outputs. In left-right response differentiation, the left-right information in the outputs is not present in the inputs, and must therefore be supplied by the animal. This is an act of *encoding* the distinction between left and right. In both cases the animal is demonstrating, by its outputs, the ability to *tell* left from right.

The reader may wonder at the exclusion, from both definitions, of the case in which left-right mirror-image outputs are produced to left-right mirror-image inputs. Here, there is neither decoding nor encoding of the left-right information. The animal that gives mirror-image outputs to mirror-image inputs no more demonstrates the ability to tell left from right than does a billiard ball that responds symmetrically to symmetrical impacts. Similarly, an animal does not demonstrate any ability to tell left from right by following a winding track, or scratching an itching leg, or flicking away an annoying fly with its tail. By the same reasoning, the child who merely copies script cannot be said to demonstrate any ability to read or write.

An animal that was perfectly bilaterally symmetrical could accomplish neither test of the ability to tell left from right. The best way to see that this is so is by means of what I like to call the *mirror test*. Suppose we have a perfectly symmetrical animal that *can* tell left from right; say it always lifts its right forepaw in response to a bell and its left forepaw in response to a buzzer. But left us now observe its behavior in a mirror. The animal is exactly the same, since it is perfectly symmetrical. But now we see that it is lifting its *left* paw in response to the bell and its *right* paw in response to the buzzer, which contradicts the original assertion that it always does the opposite. We must therefore conclude that the original behavior is impossible. A moment's reflection, so to speak, should convince the reader that this demonstration holds for any test of mirror-image discrimination or left-right response differentiation.

Readers may also like to amuse themselves by constructing perfectly symmetrical devices that *can* tell left from right by the criteria given above. I am willing to bet that they will be unable to do so, but the exercise of trying should help convince them of the logic of the argument.

Notice that the argument is a *mechanical* one, and depends on the assumption that an animal, even a person, is a purely mechanical entity. If Descartes was correct in asserting a nonmaterial basis for mind, at least in human beings, then perhaps it might be possible to transcend the mechanical restriction imposed by bilateral symmetry. But I do not think so. Perhaps this is a devious way of saying that I think that Descartes was mistaken.

Moreover, I do not think that the argument is merely specious. Most animals *do* have difficulty with tasks that meet the definition of telling left from right, and so do many humans (see Corballis and Beale, 1970, 1976, for reviews). It is a common observation that young children have difficulty telling left from right, and this is very often manifest in their left-right confusions in learning to read. It is therefore very tempting to conclude that difficulty in telling left from right is a consequence of the near bilateral symmetry of the body and nervous system. It is also of interest that it is very often difficult to *learn* to tell left from right. This suggests that the mechanisms of learning and memory may be such as to preserve bilateral symmetry in the face of asymmetrical experience. I have speculated elsewhere on how this might be accomplished (Achim and Corballis, 1976; Corballis and Beale, 1970, 1976).

In general, the bilateral symmetry of organisms is adaptive. It is achieved despite the fact that the *molecules* of living matter are *asymmetrical*, which prompted the biologist Jacques Monod (1969, pp. 16-17) to declare our outward bilateral symmetry to be "something of a fake." But I think it is not so much a fake as an adaptation to the fundamental indifference of the environment itself to left and right, an adaptation that overrides the asymmetry of the molecular building blocks. The French physician Bichat (1771-1802) long ago formulated what he called the "laws of symmetry", noting that the organs that serve "external relations" (including the sensory organs and limbs) tend to be organized in symmetrical pairs, while the organs of "organic life" (heart, stomach, etc.) tend to be asymmetrical. The reason for the symmetry of the organs of external relations was that the organism needs to be able to react to the environment with both sides of the body (Bichat, 1805).

Bilateral symmetry probably evolved first as a consequence of movement. Linear movement is most efficiently accomplished by limbs that are arranged in bilaterally symmetrical pairs. So it is that legs, wings, and fins and flippers are nearly always symmetrical, even where they have evolved independently. Given freedom to move, there is then in general no bias favoring one or other side of the body, so that sensory organs are also symmetrically located. As Martin Gardner (1967, p. 70) puts it: "The slightest loss of symmetry, such as the loss of a right eye, would have immediate negative value for the survival of any animal. An enemy could sneak up unobserved on the right!"

The reader might be tempted to think that the inability to tell left from right, a consequence of bilateral symmetry, might be a disadvantage. However this is probably true only in the esoteric and unnatural world of human beings. The natural world seldom if ever poses problems involving telling left from right. Quite to the contrary, it is generally much more important to treat left and right as *equivalent* rather than as different. Predator or prey are as likely to appear on one side as the other; if one is attacked from the left, it is as well to be equally alert to possible future attacks from the right. The face or body of another animal might be seen first in one profile, but it would be advantageous to recognize it if appears subsequently in the opposite profile.

There are possible exceptions. Animals that migrate might need to make absolute decisions about left and right in deciding which way to go, although it is not clear that this asymmetrical information need be coded structurally in the animals themselves. Directions may be specified environmentally by prevailing winds, configurations of stars, the direction of the sun, or specific landmarks. But the most obvious exceptions have to do with the human environment. The child learning to read must be able to tell left from right, at least in those cultures where script is written in a particular left-right direction. Human conventions such as driving a car or shaking hands require knowledge of which is left and which is right. The mirror test can be applied here: if you observe a group of animals other than humans in their natural habitat, there will generally be no way to determine whether the scene is viewed directly or through a mirror. But if you observe humans in human environments, it is usually easy to tell whether the view is veridical or mirror-reversed.

So far, I have dwelt on the implications of bilateral symmetry for the ability, or inability, to tell left and right. There may be another implication, to do with the salience of visual patterns that are themselves bilaterally symmetrical. In the seventeenth century, Blaise Pascal wrote that "Symmetry is what you see at a glance" (Stewart, 1950, p. 491). Ernst Mach (1893/1986, p. 94) later made it clear that this applies to left-right (or vertical) symmetry rather than to up-down (or horizontal) symmetry:

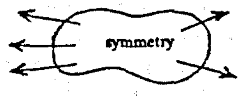
> The vertical symmetry of a Gothic Cathedral strikes us at once, whereas we can travel up and down the whole length of the Rhine or Hudson without becoming aware of the symmetry between objects and their reflections in the water. Vertical symmetry pleases us, whilst horizontal symmetry is indifferent, and is noticed only by the experienced eye.

Mach's observation was proven in more experimental fashion by Béla Julesz (1969), who showed that the symmetry of computer-generated patterns of dots that are random except for their symmetry is much more obvious if the symmetry is about a vertical axis than about a horizontal one.

I suspect, as Mach and Julesz did, that the perceptual salience of left-right symmetry is consequence of the bilateral symmetry of our own brains and bodies. No doubt it also has an adaptive significance. Many objects are bilaterally symmetrical or are nearly so, and detection of that symmetry may aid object recognition. In particular, the faces of other animals or people are bilaterally symmetrical when viewed frontally, and detection of the symmetry effectively halves the amount of detailed processing that must be accomplished. An axis of symmetry may also serve as a heuristic for discovering the top-down axis of an object (Marr, 1982).

In summary, the bilateral symmetry of animals, including ourselves, is an adaptation to the left-right indifference of the natural world in which we live and move. Notwithstanding the asymmetries observed at the molecular level, or in those fundamental nuclear forces thought to disobey the so-called law of conservation of parity, there *is* conservation of parity at the gross level at which the natural environment impinges on animals. Bilateral symmetry is a consequence of this, and in turn constrains the behavior of animals. Bilateral symmetry is adaptive because it allows animals to move linearly from one point to another, to be equally alert to events on either side of their bodies as they do so, and to be sensitive to the symmetry of other animals.

QUESTION 2



To some extent, the implications of bilateral symmetry for behavior and thought have been overshadowed in recent years by the remarkable obsession with lateral *asymmetry*, especially in humans. The most striking manifestations of that asymmetry are, first, that most humans are right-handed and, second, that an even greater majority have speech and language skills represented primarily in the left cerebral hemispheres. This left-hemispheric advantage is offset by right-hemispheric superiorities for certain nonverbal functions, such as those having to do with the encoding of spatial relations (see Corballis, 1983, for a review). But this obsession with asymmetry is no doubt dependent in part on the very symmetry that, in effect, gives it meaning.

Immanuel Kant (1783/1953, p. 42) wrote: "What can more resemble my hand or my ear, and be in all points more alike, than its image in a looking glass? And yet I cannot put such a hand as I see in the glass in the place of its original [...]" This illustrates what might be called the paradox of mirror images: structurally, they are the same, in that every point on one is matched by an equivalent point on the other. Yet they are also in a sense opposites. I recall an uncle of mine who possessed a mirror-image corkscrew and used to watch in amusement as unsuspecting guests tried to use it to extract a cork from a bottle. It *looked* like a normal corkscrew, but in order to make it work one had to turn it in the *opposite* direction. This paradox of sameness and opposition may partly explain why left and right have exerted such a fascination, and served as a potent source of myth and superstition.

The asymmetry boom in psychology began in the early 1960s with the studies of the so-called split-brain patients, who had had the fibers connecting the two sides of the brain cut in order to alleviate intractable epilepsy. With skilful testing it was possible to test the functional capacities of each side of the brains of these patients independently of the other, and so reveal something of the extent of the differences between them — an enterprise for which Roger W. Sperry (1974) was awarded the Nobel Prize. Many commentators began to insist that the two sides of the brain were not merely functionally different, they were complementary-functional *opposites*. Thus the left hemisphere was seen as rational, analytical, and logical, the right as emotional, holistic, and intuitive (e.g., Ornstein, 1972). This duality spread well beyond the confines of neuropsychology, and influenced thinking in such diverse fields as education, anthropology, and the creative arts. The terms "left-brained" and "right-brained" are now commonly used in everyday language.

This notion of hemispheric duality may owe more to the paradox of mirror images than to the evidence, which in fact implies a good deal of functional similarity between hemispheres. The two hemispheres are taken to represent the two opposite "sides", as it were, of human nature. The metaphor even gained a geographic dimension, with the left brain associated with materialistic Western culture and the right with the more spiritual East.

The symbolic potency of the left and right hands, or of the left and right sides of the brain, may be due to more than just the paradox of mirror images, however. At least, the French social anthropologist Robert Hertz (1909) seemed to have rather more in mind when he exclaimed: "What resemblance more perfect than that between the two hands, and yet what a striking difference there is!" (cited in translation by Needham, 1973, p. 5). It was not just that the hands were mirror images, it was also that they were *functionally* so different. Try asking a person to write, or to throw a ball, with each hand in turn, and the difference in function will surely be apparent. This functional difference belies the close *structural* similarity of the hands.

And so it is with the sides of the brain. They *look* like mirror-images of one another, and yet in the great majority of people one side can produce speech and the other cannot. The paradox is again not just that of mirror images, it is also that of function versus structure. Part of the fascination of this paradox lies in the suggestion of a nonmaterial basis for functional asymmetry that transcends the material symmetry — a surreptitious (and probably mostly subconscious) appeal to Cartesian metaphysics (Corballis, 1980).

The appeal to Descartes goes further. Descartes thought that the influence of a nonmaterial soul was unique to humans, and that other animals were mere automata. Human uniqueness was manifested in the extraordinary flexibility of human language, and in the exercise of free will. Functional laterality also seems uniquely human, for although other animals do exhibit functional asymmetries they do not seem so marked or distinctive as those in humans. Moreover, the functions for which laterality is most apparent, namely, manual skill and language representation, are precisely those that seem to distinguish humans from other animals. Only humans, it is said, possess true language (e.g., Chomsky, 1966), and our extraordinary mechanical inventiveness may reasonably be traced to our ability to fashion things with our hands — or to fashion things that fashion things with our hands. (Like language, manufacture also has a recursive quality.)

It is therefore very tempting to see in lateral asymmetry a basis for the Cartesian idea that humans uniquely possess a nonmaterial soul that transcends physical structure. But where Descartes saw the soul as operating through the pineal body, it now seems more appropriate to attribute a uniquely human consciousness to the left hemisphere of the brain. Aspects of this idea are more or less explicit in the writings of Jaynes (1976), Eccles (1965), and Popper and Eccles (1977). But I believe that it has been a powerful *implicit* source of fascination, and may have added to the popularity of ideas about left-brain/right-brain in everyday culture as well as in neuroscience.

However if laterality holds the key to human uniqueness, I do not think it does so through any nonmaterial intervention. Rather, I think that humans may have discovered a principle of *generativity* that is in most (but not all) people mediated by the left cerebral hemisphere. This is indeed the main feature that distinguishes human language from other forms of communication between animals; humans can use the rules of language to produce and understand an essentially unlimited number of sentences. Probably every sentence in this essay will be new to the reader, yet I hope my meanings are generally clear. The manufacture of objects has a similar generative property; humans have an extraordinary capacity to make *new* things, and to comprehend what new things made by others are for.

There are reasons to believe that this generativity may carry over even to visual perception. Biederman (1987) has suggested that recognition of visual objects is accomplished by segmenting them into parts, which he calls *geons*. He argues that about 36 geons are sufficient to generate, in idealized form, virtually all the objects we know. There is an obvious parallel here to the human ability to generate meaningful words and sentences from the small number of elementary speech sounds known as *phonemes*. Only about 44 phonemes are necessary to create the corpus of utterances in American English.

There is some evidence that people's ability to form visual mental images is largely, if not exclusively, under the control of the left cerebral hemisphere (Farah, 1984; Kosslyn, 1987). More recently, Kosslyn (1988) has qualified this conclusion by suggesting that the right hemisphere *can* generate visual mental images, but only in a holistic manner; the left hemisphere, by contrast, does so in piecemeal fashion, by arranging component parts into a whole. This again suggests a left-hemispheric basis for *generation*.

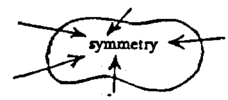
A generative mode of representation may have come about initially simply because the early hominids gradually evolved the ability to manufacture a diversity of objects. Generativity is a powerful heuristic, since it allows the description, representation, or construction of an enormous variety of composites, given only a limited vocabulary of elements. For example, Biederman (1987) calculates that from a total pool of only 36 geons, and choosing only three at a time, one can construct about 154 million possible three-geon objects! Similarly, there is virtually no limit to the number of new words that can be coined from the limited number of phonemes at our disposal, and many of these words are of course required to name new objects.

A generative mode of representation may have limitations, however, especially when it comes to capturing subtle properties. For instance, one may describe a human face in words, or one may represent it visually in terms of Biederman's standardized geons. But such representations are more appropriate for describing faces in general rather than a particular person's face. In capturing the subtleties of a particular face, a picture is worth a thousand words. It is beyond the scope of representation by geons.

I therefore think it plausible to suppose that the *right* hemisphere may have retained a holistic, iconic mode of representation that may be more appropriate for naturalistic stimuli, but relatively inflexible for the representation of manufactured objects. So there may be some truth after all to the idea of the right hemisphere as predominantly holistic, with the left as predominantly analytic and generative. However I have no wish to suggest that the differences between the hemispheres owe anything to a nonmaterial component. I suspect, moreover, that the differences are not absolute. A generative mode of representation may have been superimposed on a left hemisphere that, in our primate forebears, may have sustained a mode of representation basically the same as that of the right.

In summary, it is asymmetry rather than symmetry that has had the stronger centrifugal influence, coloring many aspects of human life and culture. But the symbolic potency of human asymmetry owes much to the symmetry from which it derives. The functional asymmetry of hands and brain belie their structural symmetry, and stand in contrast to the lack of comparable asymmetries in other animals. Of course these comparisons should not be exaggerated; the human brain does exhibit consistent structural asymmetries that seem to have some correlation with functional symmetries (e.g., Geschwind and Levitsky, 1968; Galaburda *et al.*, 1978), and nonhuman animals show some functional asymmetries that bear at least some resemblance to those in humans (e.g., Denenberg, 1981; Hamilton and Vermeire, 1988). Even so, human functional asymmetry is sufficiently singular to suggest that it may well hold the key to our humanity.

QUESTION 3



Although concepts derived from the study of cerebral and manual asymmetry in humans have influenced our culture in diverse ways, the influence has not been all unidirectional. At least some of the dichotomies that have been linked to the two sides of the brain are old, and predate the discovery of cerebral asymmetries. The sides of the brain have served as a modern vehicle for pre-existing and often ancient polarities.

Before the discovery of cerebral asymmetry, it was the two *hands* that attracted opposite poles of various dichotomies. In the Pythagorean Table of Opposites, recorded by Aristotle, the right was associated with the limited, the odd, the one, the male, the state of rest, the straight, the light, the good, and the square, while the left was associated with the unlimited, the even, the many, the female, the moving, the curved, the dark, the evil, and the oblong (Lloyd, 1962). Very similar associations are found among contemporary tribes of Africa (Needham, 1967). In most cases, the attributes associated with the right were of superior status to those associated with the left, a consequence no doubt of the universality of right-handedness among human populations.

The particular associations of right with the male and left with the female seems to have been virtually universal, notwithstanding the evidence that women are if anything more likely to be right-handed than are men (e.g., Oldfield, 1971). The Maori expression *tama tane*, meaning literally "male side", referred to the right side, and *tame wahine*, "female side" referred to the left. Empedocles, in the 5th century B.C., thought that males were hotter than females and the right hotter than the left, so that the sex of a child was determined by the leftward or rightward location in the womb. (Empedocles is also said to have destroyed himself by leaping into the crater of Mt. Etna.) The association even persists in modern biology. Ursula Mittwoch (1977) notes that in hermaphrodites with mixed sex organs testes are found more often on the right and ovaries on the left, and suggests that the same lateralizing tendencies may be present in normal males and females. A more subtle twist is provided by Wilhelm Fliess (1923), a one-time friend and colleague of Sigmund Freud, who argued that left-handedness brings out the tendencies of the opposite sex, so that left-handed men tend to be feminine and left-handed women masculine. I do not know of any evidence that this is in fact the case.

With the discovery of cerebral asymmetry, these dichotomizing influences went to our heads. For instance, a recent theory by Geschwind and Behan (1982) might also owe something to the age-old association between sex and the left and right sides. They suggest that testosterone slows the development of the left side of the brain, so that males tend to be more "right-hemispheric" than females. This explains, they say, why there is a higher proportion of left-handedness among males than among females, and why males are more likely to suffer from disabilities in reading or speech (which are thought to depend primarily on the left side of the brain). Geschwind and Behan also suggest that a high level of intra-uterine testosterone increases susceptibility to disorders of the immune system, so that these, too, tend to be associated with left-handedness. It is too early to tell whether these speculations are true, or whether they are yet another manifestation of left-right mythology.

Joseph E. Bogen (1969), one of the surgeons who pioneered the split-brain operation for the relief of epilepsy, enthusiastically interpreted the evidence on functional differences between the two sides of the brain in terms of complementary modes of thought, referring to the left brain as "propositional" and the right brain as "appositional". But he was aware that the distinction he sought to characterize was an old one, predating the neuropsychological evidence. He referred, for instance, to the pre-Confucian Chinese concepts of yin and yang, the Hindu distinction between Buddhi and *manas*, Lévi-Strauss's dichotomy between the positive and the mythic. One might add C.P. Snow's (1959) distinction between the sciences and the arts.

Harrington (1985) has reminded us that there was a epidemic of speculation about differences between the two sides of the brain in the latter part of the 19th century, following the realization in the 1860s that Bichat's "laws of symmetry" did not strictly hold. Some of the dichotomies that were proposed resemble those of the modern era of speculation (but were strangely forgotten until Harrington reminded us of them), while others seem to reflect obsessions peculiar to the 19th century. Not surprisingly, it was suggested that the left hemisphere was male, the right hemisphere female (Delaunay, 1874). In view of the 19th-century concern over Darwinian theory, it is perhaps also not surprising to find the left hemisphere associated with humanness, the right with animality (Broca, 1869). There was also much speculation about the organic basis of racial differences, so we find the left hemisphere associated with white superiority and the left with black inferiority (Delaunay, 1874). The association of the left hemisphere with intelligence and the right with emotion (Luys, 1881b) was extrapolated so that the left hemisphere stood for reason and the right for madness (Luys, 1881a).

As Harrington points out, similar associations were revived in the 1970s. However the dichotomies of the earlier era reveal rather more of 19th-century values, and were colored by notions of the superiority of whites over blacks, males over females, and reason over emotion. The dichotomies that emerged in 1960s and 1970s, by contrast, probably owe at least something to black power, women's liberation, the protest against the Vietnam War and the military-industrial establishment, and the rise in popularity of Eastern religions. So the right hemisphere is accorded a more romantic status, the symbol of the flower children. In the 1960s slogan "Make love not war", it was surely the right hemisphere that stood for love, and the left hemisphere for war.

Yet even this characterization can be found in earlier writings, as in the following remarkable passage written in 1914 by Maurice Maeterlinck, the Belgian man of letters, distinguishing between what he called the Western and Eastern lobes of the human brain:

> The one produces here reason, science, and consciousness; the other secretes yonder intuition, religion, and subconsciousness. The one reflects only the infinite and the unknowable; the other is interested only in what it can limit, what it can hope to understand. They present in an image that may be illusory, the struggle between the material and moral ideals of humanity. They have more than once tried to penetrate each other, to work in harmony; but the Western lobe, at least over the most active part of our globe, has up to the present paralyzed and almost destroyed the efforts of the other. We owe to it not only our extraordinary progress in all the material sciences, but also catastrophes such as we are experiencing today, which, unless we take care, will not be the last nor the worst. It is time to rouse the paralyzed Oriental lobe! [quoted by Massis, 1926, p. 487].

A remarkably similar theme was pursued, apparently independently, by Hertz (1909), who maintained that thinking in dichotomies was "inherent in primitive thought", and that handedness was actually fabricated in human culture to resolve the conflict between oppositions:

> For centuries the systematic paralyzation of the left arm has, like other mutilations, expressed the will animating man to make the sacred predominate over the profane, to sacrifice the desires and interests of the individual to the demands felt by the collective unconscious, and to spiritualize the body itself by marking upon it the opposition of values and the violent contrasts of the world of morality [translated by Needham, 1973, p. 21].

To counter the repressive influence of handedness, Hertz advocated ambidexterity, "to develop the energies dormant in our left side and in our right cerebral hemisphere" [Needham, 1973, p. 22].

These cries for the "release" of the left hand—right hemisphere have their modern counterpart in pleas for education of the right hemisphere. Garrett (1976, p. 244), for example, bemoans "the tragic lack of effort to develop our children's right brain strengths. That potential — a source of [...] creative, artistic, and intellectual capacity — is largely unawakened in our schools."

So is lateral asymmetry *merely* a cultural phenomenon, imposed for political or moral ends? In its extreme form, as proposed by Hertz for example, there is surely a touch of paranoia in that view. I have argued elsewhere that the evidence overwhelmingly favors a biological basis for human right-handedness and hemispheric asymmetry (Corballis, 1983). Given the ancient and universal practice of assigning opposing values to the two sides, however, we must surely remain alert to the mythological component in the interpretation of left-right asymmetries. But as Harrington points out, the fact that similar ideas about hemispheric and manual asymmetries have been repeated at different stages in history does not mean that they are wrong. The very persistence of the ideas, and the fact that they tend to be rediscovered in ignorance of earlier formulations, suggests at least some measure of truth.

And I do not think we should be *too* concerned at the mythical element. I hope I may be forgiven the luxury of concluding by quoting myself:

Another dangerous dichotomy lurks, however: that between science and myth. The two surely lie at the extremes of a continuum; no healthy science is without a dose of myth, just as all myths convey a measure of truth. I have no doubt that conceptions of human laterality will continue to evolve both as a result of careful scientific evaluation and in response to broader human concerns [Corballis, 1985, p. 637].

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