

NEW RELEASES

The Many Sides of Asymmetry

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Right Hand, Left Hand: The Origins of Asymmetry in Brains, Bodies, Atoms, and Cultures. Chris McManus. Cambridge: Harvard University Press. 2002; 432 pp.

In an age when popular science books seem to be written about just about anything—there are several currently circulating, for instance, on the topic of coffee, and two on the role of cod in world history—we have here an entry that discusses an apparently idiosyncratic and potentially trivial topic: asymmetries of various kinds. It is also a book that ranges widely across normal disciplinary boundaries, as suggested by the book's subtitle: "The origins of asymmetry in brains, bodies, atoms and cultures." It turns out that "handedness" or asymmetry can be found in phenomena ranging from the smallest to largest scales of organization. We are told of left-handed sub-atomic particles such as neutrinos, left-handed amino-acids, the left-sided heart, and our lateralized brains, in which language abilities are usually found in the left hemisphere. The book's author, Chris McManus, a professor of Psychology and Medical Education at University College London, is someone who admits to a nearly life-long obsession with this topic. This isn't surprising, since it would take a life-time to acquire the expertise necessary to cover the range of topics so lucidly conveyed in this book. McManus really covers a lot of ground, and the book makes for a fascinating read. One can't help but learn some new things and gain new perspectives. McManus also has a real passion for his subject, making for some

lively prose, with fascinating anecdotes. But it was winning a prize for popular science writing in a contest sponsored by a British medical trust that put the idea of writing the book into the author's head. Given that no one but McManus is likely to be expert in all the areas he covers, it's just as well that he deals with each topic presuming little background.

But why should anyone really be interested in so arcane a subject as symmetry? Is this book simply something one picks up to flip through, looking for that juicy tidbit to impress listeners at the next cocktail party? Handedness or symmetry, after all, is not something that is regularly advertised in academic job descriptions as an area of expertise, so one need not read this to catch up on some well-recognized area of research.

One might wonder, in particular, why should an anthropologist read a volume like this? Much of what the book covers falls into the domains of other sciences like physics and biology. But the book's title mentions "asymmetries in culture," and several chapters are devoted to analyzing cultural topics. For example, McManus provides explanations for why some countries drive on the left, and why some scripts move from left to right (e.g., English), while others are written in the opposite direction (e.g., Hebrew). These phenomena are basically just social conventions, sometimes acquired by transmission from other groups, so no universal principle is at work here (which is why there are examples of both kinds of rules in each case).

But other features of culture and society are not so variable. In fact, there is, McManus argues, a universal symbolic association of right with good and left with bad. For example, he provides lists from Aristotle (derived from "principles" established by the Pythagoreans) and a variety of cultural groups (such as the Gogo of Tanzania) that can be compiled to produce a compelling world-view based on this simple dichotomy:

RIGHT	LEFT
odd	even
one	many
male	female
straight	crooked
light	dark
good	evil
moon	sun
sky	earth
east	west

life	death
back	front
above	below
sacred	profane
village	forest
clean	dirty
strength	weakness
black	white
cool	hot

Lots of rituals must go in clock-wise progression as well, McManus notes (just think of passing food around a table). Religions are full of symbolic asymmetries. The Bible refers to the “right hand of God,” for instance. Such universal principles beg for explanation, not just cataloguing, McManus argues. But there is no universal theory of symbolism, and so no way to make sense of this apparently universal tendency to equate handedness with other traits. These tendencies, McManus notes, are ensconced in etymology. The word *left* derives from the Old English *lyft*, which means “weak” or “useless,” while the original Latin word for left is associated with “sinister” (so lefties are sometimes called “sinistrals”).

There are also social components to McManus’ story. Chapter 11 details the long-term stigmatization and suppression of left-handers (right-handed writing was enforced in schools for many generations; the Zulus scalded the offending hand of left-handers to force them to use the right). Lefties have also been ignored by manufacturers (although there are now e-stores catering to the sale of specially designed items like scissors, for those who do things with the “wrong” hand). The author appears to feel this discrimination intensely. “Left-handers are a people without a history,” he says (p. 281). (Although McManus is apparently himself a right-hander, his mother and daughter are left-handed.)

Other chapters deal with the biology and physics of “handedness” or asymmetry. Each begins with a nice historical episode that highlights some question which is then developed through the rest of the chapter. For example, here’s an interesting question: How does the developing fetus know to grow its heart on the left-hand side of the body when there is no genetic instruction that can refer to something outside the body, and thus provide a frame of reference? The growing protoplasm is otherwise symmetric, so what guidepost can a gene use to say “go left here and begin growing a heart?” The answer is that body’s development depends on environmental information to provide the necessary perspective: we aren’t just a product of our genes because we do (very) regularly

have our hearts on the left. This is a message which should comfort just about everyone. On the other hand, bodily symmetry is an indicator of “good genes,” and healthy status, or at least an ability to develop properly in the face of potentially disrupting environmental influences, and many studies have now shown that symmetrical faces and bodies are seen as more attractive to those looking for sexual partners. So biology and culture interpenetrate one another.

To aid comprehension, the text is leavened with a cornucopia of pictures and poetry, diagrams and dialogues, so that the reader need never lurk too long with any one fact. These aids are often to the point, and informative, but sometimes grate on the sensibility, because they come so thick and fast. You may worry that this book is just an amalgam of trivia. Indeed the author himself recognizes this worry, saying that a couple of chapters of the book (12 and 13) “are of necessity collections of miscellanea, often interesting but inevitably lacking a coherent theme” (p. 284). And when you read them, you find that indeed they are just little factoids devoid of a larger context—real cocktail party fodder like the fact that Peter O’Toole, the actor playing T.E. Lawrence in the movie *Lawrence of Arabia*, at one point eats with his left hand, something no one in the Middle East would do.

The reader “interested in following the big story about symmetry and asymmetry in the universe” (p. 284) is invited by the author to fast forward to Chapter 14. What can be found there? A grand theory explaining symmetry at all levels of organization, from atoms to culture. Does this theory provide a major insight into the nature of reality? Maybe. McManus does not identify a new universal principle or force that makes everything in the universe symmetric, but he does provide a multi-step story about how the fundamental asymmetry in matter is connected, through a series of relationships between phenomena at different scales of organization, to our asymmetric bodies and thence to the linguistic tendencies I mentioned earlier (which associate the left hand as the “axis of evil”). Other books that cover such a wide a range of topics—some of which even take pattern itself to be the explanandum—typically use complexity theory, or fractals or some such as their meta-theory to provide the “universal covering laws” for the phenomena in question. Admirably, McManus doesn’t rely on some overarching “theory of everything” to put the factoids he has so carefully accumulated into place. He is to be congratulated on not resorting to such a facile, and often arid, “explanation” of this sort. There is no single, universal principle of asymmetry being expressed at all scales of reality, no rule that encompasses quarks, hearts and rituals, nor does it seem sensible to suggest one. Instead, the book deals with each level of organization, in all its natural wonder, and then attempts to create a specific hypothesis to address the fact that asymmetries appear

at all these different levels. The development of this theory is a bit of creative work that doesn't often appear in books designed to be read by a general audience.

The theory begins by noting that there is a nice cross-species correlation between brain laterality and handedness: most animals don't have significant specialization in activity between hemispheres of their brains, while humans do; humans are also more biased toward right-handedness than our closest living relatives, the apes. (The bias is only about 60 to 70 percent right-handedness in apes, but nearly 90% in humans.) In humans, right-handers tend to process language in the left side of their brains, while lefties reverse this pattern. This has naturally led people to look for a causal link between language laterality and handedness. McManus has developed the simplest possible model to explain this association (which isn't a simple correlation)—as well as other known features of handedness, such as the fact that identical twins can have opposite preferences, and that two right-handed parents can have left-handed children. It is a single gene model in which one allele for the handedness locus, which he calls C (for "chance"), does not bias handedness, but another allele, D (for "dextral"), does. A CC person has a fifty percent chance of favoring either hand, while a DD person is always right-handed. I won't go into the details here about what happens when an individual is DC, but this model does mimic the known facts beautifully, although it has not been confirmed by finding the relevant locus on the human genome.

It is widely believed that left-handers are more likely than right-preferring folk to suffer from autism, dyslexia, schizophrenia, stuttering, and other mental disorders. But lefties are also supposed to be more likely to be members of Mensa (the high IQ society) and creative people like musicians and (some) academics. (McManus himself discounts the evidence for these associations in his book, saying that the ideas that left-handers are more intelligent and creative are among the "vulgar errors" associated with handedness in the popular imagination, being not well established scientifically—see pages 297-8). McManus assumes that his hypothetical genetic locus for handedness influences where the motor control responsible for both language and the manual dexterity associated with handedness winds up in the brain, so there is a genetic link between where language ability appears in the brain and which hand someone uses to make things. In this way, McManus's single-gene theory also explains why left-handers tend to be either high or low on the mental scale. In effect, inheriting a copy of the chance gene increases phenotypic variability because it merely cancels out the right bias in both brain organization and handedness. This can be good or bad, depending on whether the mutant form winds up being more or less functional than the norm.

According to McManus' genetic model of handedness, the C allele which produces left handedness (by canceling out the pre-existing bias to the right rather than directly coding for left-handedness) is a recent mutation in the hominid line that occurred somewhere between 20,000 and 100,000 years ago. He further hypothesizes that the handedness gene is a mutant of one present in all vertebrates, the *situs* gene, which is responsible for hearts being on the left side of the body. The *situs* gene, in turn, happens to place the heart on the left because of the action of particular L-amino acids in the body. These molecules, which make up most living things on Earth, acquire their left-handed form thanks to the operation of lop-sided effects at the sub-atomic level (the force of "weak interaction" between particles). In this way, McManus has managed to link sub-atomic forces, through a series of causal links, to body asymmetries, brain asymmetries, language and culture.

Is this theory successful? Well, it is testable, which is always advantageous. So the book has something not just for the interested amateur, but also for scientists—it represents not just a recounting of what is already known, but a new project to work on as well. The game is on.