Review

The Symbolic Species: The Co-Evolution of Language and the Brain. By TERRENCE W. DEACON. London and New York: W. W. Norton, 1997. 528 pages. $29.95.

Nothing is more relevant to exploring the interface between science and religion, or more fascinating, than studies about the brain. However, we are often hampered in our use of such studies, because either we lack the sophisticated knowledge required to understand them, or we demand that the explanation be in terms simple enough for us to grasp.

Although Terrence Deacon's new book is not unduly difficult to comprehend, and although it is quite pleasant to read if one concentrates or rereads at certain key points, it would be misleading to say it is light reading. So I want to begin this review by reminding the prospective reader how simplistic it is for us to want a too-easy explication of what is perhaps the most complex three pounds of matter in the universe.

And yet please understand that although neuroscientist Deacon has not written another glib and popular glossing of brain processes, he has constructed a thoughtful analysis that everybody interested in the issues simply must read, whether they agree with him or not. He has marshaled evidence to produce a bold theory that will surely turn out to be wrong in some respects, but the basic proposition is so elegant and so well argued that it must be digested. It also has the great advantage of lending itself to testing, and thus it seems likely that the theory will be modified toward ever greater elegance as new evidence and new concepts come in.

The book has three basic parts. The second and third parts are fairly straightforward, and I will dispose of them before concentrating on the first part, which I see as most important. The second part is the "hard science" part of the book, full of interesting studies and concepts from neuroscience. Lay readers will learn a lot here, and will find that what they previously learned from Pinker or Damasio is significantly impacted by the book's earlier chapters, which I'll get to in a moment. The third part of the book explores the implications of the first two parts, and should be especially interesting to *Zygon* readers, because those implications will enrich and modify their understanding of social and religious processes, even including how we arrive at god-concepts. I will briefly elaborate on this third part further, after attempting to describe the all-important first part.

[*Zygon*, vol. 34, no. 1 (March 1999).]
 ISSN 0591-2385

The first part is the "theory-building" section. Here Deacon explains how he uses the terms *iconical*, *indexical*, and *symbolic*. I found this section difficult not because Deacon was less than his always-articulate self, but because the ideas expressed are so counterintuitive. Deacon is completely aware of this, and he tries to help the reader by using good examples, careful prose, and a series of diagrams that build on each other until the edifice is complete. And fortunately, the concepts finally become almost second-nature, like when one is working with a mirror image and suddenly starts thinking comfortably in terms of the reflected reality.

Iconical representation is a one-to-one representation. A picture of a trash can represents the idea of throwing something away, or an image of a lettuce-head represents lettuce (say on a computer key such as Duane Rumbaugh uses in his chimpanzee research). It is an easy mistake to make, Deacon thinks, to confuse iconic representation with symbolic representation.

Indexical representation is one step further removed from the thing to be represented, because the form of the representation is a bit more abstract. An old-fashioned gasoline gauge indicates the amount of fuel left, but one has to correlate the needle's location with knowledge in one's head in order to understand how much gasoline is there. Again, it would be easy to think of the gauge as a "symbol" of reality, but Deacon reserves symbols for a more complex kind of representation (or re-presentation, as one soon learns to format the word).

This is the most crucial point in the series, so let me list some other examples. A wolf knows to watch out for a competitor when it smells urine markings inside its territory. The representation here is indexical, not iconic, because it requires translation—it indexes or indicates the reality just like a gauge does. Among humans, a policeman's outstretched hand to represent "Stop" is iconic, because it is so closely related to putting that hand on your chest and forcing you to stop. Likewise a stop sign with a picture of the policeman's outstretched hand would still be iconic. But a simple octagonal sign seen in the distance would also be recognized as a stop sign, because it serves as an index or marker that the driver has come to recognize. There is no real complexity to this recognition, even though it is one step removed from the outstretched hand, and there is every reason to believe that Rumbaugh's chimps could easily learn the indexical representation and respond appropriately by stopping.

Not incidentally, indexical representation often builds on iconic representation, though it may be learned directly. In animal training as well as in childhood development, it is common to go through stages from actual physical manipulation (say in teaching a dog to sit) to an iconic representation (moving the outstretched palm downward), to an indexical representation (say a single short blast of a whistle). In this case even the command "Sit," which sounds an awful lot like a symbol, is understood by Deacon to constitute indexical communication.

Later, in discussing the evolution of the brain, Deacon explains why one would expect both iconic and indexical representation to be common in the animal world. The neurons involved derive from middle-brain and even limbic structures. But the jump to a more complex symbolic representation has been hard to explain

without postulating a major and dramatic evolutionary change, which Deacon refuses to do.

But I am getting ahead of the story. Now I must try to explain what Deacon means by *symbolic*. In animals with sophisticated brains like those of our ancestors and closely related species, one would expect to find a large library of icons and indexical representations. Seeing-eye dogs learn almost 200 commands, and nonhuman primates learn upwards of 1,000 human words and can use them appropriately if (and only if) there is a huge external support system (trainers, regular reinforcement, computers, etc.). These words have to be memorized and are easiest to remember when they are iconical; yet even indexical representations can be embedded in neural pathways and subsequently used—even taught by an animal to its associates.

What is lacking in animals, but common in even very young humans, is a *system* of iconic and indexical representation, which itself becomes the source of new relationships between and among the old representations. Deacon depicts the icons as points on the ground, and the indexical representations as lines arising vertically from those points. But he depicts symbols as lines above the ground that connect and express relationships between and among the indexical re-presentations! Thus true symbols are highly sophisticated and interrelated abstractions of that which is already fairly abstract, namely indexical representations.

To construct a symbolic representation takes some powerful computational processes in the brain, and Deacon traces the evolution of the brain to show how and why it must have arisen in our ancestors. He also shows how the emerging "language," or symbol-sets, can be so easily modified in their superficial aspect, but depend on underlying structures that are common to all humans. To me this seems to validate a kind of Chomskyan "deep structure," but Deacon goes to lengths to distinguish his theory from Chomsky's on technical grounds.

(This may also be the place to distinguish Deacon from Pinker and Damasio, at least in gross and simplistic terms. Pinker sees the brain as having had specialized language structures from the beginnings of language, whereas Deacon thinks more ordinary brain structures were co-opted for language, and only later evolved whatever specialized features they now have. Damasio and Deacon are virtually on all-fours, except for one slight difference. Damasio denies any special role for words, seeing them as images that result from cross-talk among other brain processes; that is almost like Deacon, except that Deacon would see Damasio as unnecessarily telescoping the iconic with the indexical and symbolic.)

Deacon insists that the ability to make symbolic representations resulted when structures originally evolved for other functions were co-opted by language, and only thereafter did subsequent evolution favor brain and social changes that built on and extended those preexisting supports. One of the most powerful parts of Deacon's theory is his showing how evolution used these emerging symbolic abilities to enhance our social structure.

In the final third of the book, where Deacon explores some implications of his theory, one keeps thinking about other current research related to social

structures. As sociobiology works to establish the mathematics of social practices, Deacon's theory will be highly useful as a model to explain why and how such practices emerged. More to the immediate interests of *Zygon* readers, Deacon's work offers a solid support to theologians like Philip Hefner who emphasize the social aspects of human life as reflected in human theology and like Gordon Kauffman who emphasize the symbolic aspects of theology. On the other hand, Deacon's work challenges those writers (among whom I include myself) who tend to emphasize the individual implications for religion and philosophy. Like any wonderful book, this is one that all of us will find ourselves consulting again and again, in order to fully digest and use its extensions of and challenges to our previous understanding.

Michael Cavanaugh
Lawyer and Independent Investor
744 Dubois
Baton Rouge, Louisiana 70808