

REVIEW

Revolution on the mind

The Embodied Mind: Cognitive Science and Human Experience

by Francisco Varela, Evan Thompson and Eleanor Rosch, MIT Press, pp 308, \$25/£22.50

Bright Air, Brilliant Fire: On the Matter of Mind

by Gerald M. Edelman, Basic Books, pp 280, \$25

Daniel C. Dennett

TWO books published within months of each other, each critical of the reigning family of working assumptions known as cognitive science, each calling for a more biological vision of the mind and even sharing a slogan: we must see the mind as "embodied". Is this merely a striking coincidence or perhaps a case of convergent evolution of scientific ideas?

There are further striking similarities. Francisco Varela, the principal author of *The Embodied Mind*, is an immunologist turned neuroscientist, and so is Gerald Edelman, author of *Bright Air, Brilliant Fire*. Both books call for a biological counter-revolution to succeed the cognitive revolution, but neither is attracted to the more radically revolutionary "quantum gravity" speculations of Roger Penrose.

That is where the similarities end, however. Varela and his co-authors have a deep and sympathetic understanding of the current state of play in cognitive science, and hence can aim a genuinely revolutionary message at its heart. Edelman, on the other hand, bases his attacks on superficial, out-of-date caricatures, so he ends up unwittingly reinventing the wheels that cognitive scientists have been considering, improving and replacing for years.

In the early days of the cognitive revolution against the reigning ideas of behaviourism, the brainish beginnings of the movement—in the work of such pioneers as Norbert Wiener and Warren McCulloch—were swept aside by an ideology that called for ever higher levels of abstraction. According to these ideas, we could safely ignore the messy details of functional brain organisation for the time being, until the computational problems the brain must solve had been clarified.

This was, and still is, a good idea if cautiously used. But at its most fiercely doctrinaire, it became a brittle ideology—I have

called it High Church Computationalism—that was not just unbiological but even curiously antibiological. If you wanted to study the mind, there was really no reason at all to study the brain.

One of its most radical adherents in artificial intelligence once said to me, in response to the growing interest in neuroscience among his colleagues, "Neurons, basal ganglia, thalamic nuclei! If I have to learn about the brain, I'm going into industry!" He did, but that was about 10 years ago, and the re-biologisation of cognitive science was already well under way.

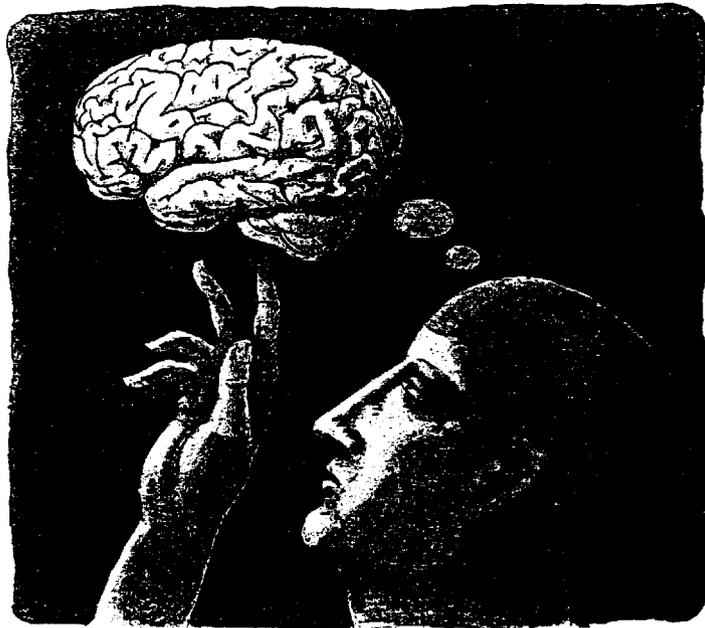
Varela and his co-authors (Evan Thompson, a philosopher; and Eleanor Rosch, a psychologist) understand this well. They applaud the recent developments, which they discuss in detail and harness to their cause, but go on to call for something more

is that their many insights owe less than they think to their study of these exotic traditions. But perhaps I am mistaken, and at least they are convincing about the need for cognitive science to take account of the forms of consciousness that arise in meditative states. Moreover, their ideas about how to pose the fundamental questions of cognitive science have considerable useful originality. The time they have devoted to their meditations has certainly done them no harm, so others with a taste for these practices should give it a try.

Edelman's book is largely a summary of his speedily written trilogy, *Neural Darwinism* (1987), *Topobiology* (1988) and *The Remembered Present* (1989—all published by Basic Books). The centrepiece of his account of consciousness is his theory of neural group selection, according to which our brains are designed by two different intracerebral evolutionary processes, one a developmental process involving Darwinian competition between populations of neurons only partially constrained by genetics, and the other a learning process accomplished by a swifter, less permanent, selectional process that strengthens or weakens neuronal connections temporarily. This appropriate pruning is accomplished by "re-entrant" reverberations between "maps" composed of neuronal groups organised by the first selectional process.

Computer simulations of these processes demonstrate the capacity of such systems to exhibit uninstructed learning of simple cognitive competences, tracking a moving light source or learning to categorise visible shapes and textures. This is the Darwinian foundation on which Edelman would build a theory of consciousness.

There is nothing revolutionary about Edelman's idea. Theories of individual development and learning based on Darwinian mechanisms in the brain have been around for years. Since the psychological competences of Edelman's simulations are substantially more rudimentary than the psychological competences exhibited by other models that also make fundamental use of intracerebral evolutionary mechanisms, it would have been useful for him to explain why he thinks that his model, though simpler, probes deeper. Some of the models by neuroscientists (Stephen Grossberg, Terry Sejnowski, William Calvin,



Ingram Pitt

radical than these mere reforms.

Just how radical? One can get a flavour of their impossible-to-summarise proposal by considering their heroes: Buddha and the French phenomenologist Maurice Merleau-Ponty. They argue that Buddhist meditative traditions offer not just a wealth of phenomena of human consciousness, but otherwise unobtainable insights into the relations of embodiment that permit us to understand how the inner and the outer, the first-person point of view and the objective point of view of science, can coexist.

Reform, as we know, is the enemy of revolution, and an ardent reformer such as I must announce that I am almost entirely unpersuaded about this. My own diagnosis

to mention three very different ones) and researchers on genetic algorithms (John Holland and others), for instance, are apparently more advanced in some ways than Edelman's models, but he either does not know of them or does not understand their relevance to his own project, for he never mentions them. He does briefly criticise connectionism, but his charges apply either only to the earliest, simplest connectionist models, or to his own models as well.

When he then turns to consciousness, he misunderstands the philosophical issues he addresses at an elementary level. He thinks

that his own computer simulations, thanks to their use of pseudorandom number generators at key places, are not algorithms, a confusion that betrays his simplistic vision of artificial intelligence. He is, in spite of himself, a practitioner of "strong AI", not a foe. He also declares himself against functionalism and in favour of "qualia" (the quantities of experimental states), and then adopts a functionalistic definition of qualia that no true believer in qualia would tolerate. This is not to say his account is wrong; it is just neither revolutionary nor original.

Edelman ends his book with a "Critical postscript" devoted to bashing (as he says)

the doctrines he takes to be central to cognitive science. For the most part he refrains from naming his opponents, which is just as well, since his targets bear only a faint resemblance to theories seriously maintained in recent years. His *bête noire* is a view of the mind as a Turing machine (its paper tape is the world, full of unequivocally predefined essences) that to my knowledge has never been maintained by anyone. There is this to be said for shadow-boxing: the one you risk hurting is yourself. □

Daniel C. Dennett is at the Center for Cognitive Studies at Tufts University, Massachusetts.