Darwin's Dangerous Idea. Daniel C. Dennett. New York: Simon & Schuster, 1995, 587 pages, $30.00 hard.

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Dennett believes that Darwin's idea of natural selection is the best idea that anyone has ever had, "ahead of Newton and Einstein and everyone else" (p. 21). The idea of natural selection appears "dangerous" to many, Dennett suggests, because its blind, mindless process threatens to replace cherished visions of a divine design of human life and mind. Darwin's idea puts pressure on us to bid a final goodbye to design by gods, minds, Platonic realms, and so forth. This, of course, is not a new idea, but Dennett takes evolutionary design in some interesting new directions.

The Substantive Contribution of the Book

The thesis skillfully worked and re-worked all through this book is that Darwin's blind, ever-plodding natural selection (resulting in the blind accretion of fitness) can account for the design of *everything* associated with life and mind — from bacteria to an ode to a nightingale, to Dennett's book itself. Dennett describes and argues for a boundless building/lifting power of natural selection that is based on an interesting marriage of three conceptions: algorithms, evolutionary design space, and memes. This three-pronged account of the "lifting" power of natural selection comprises substantive contribution of the three parts of the book. Throughout, Dennett insightfully argues the implications of his approach for major currents of thought in cognitive science, computational science, and the philosophy of mind.

While readers of JMB are likely somewhat familiar with algorithms, evolutionary design spaces, and memes, Dennett provides a new synthesis of them that is worthy of comment and critique. For those not familiar with evolutionary design spaces, and the term meme (rhymes with "beam"), I will provide brief descriptions of them in a moment.

Algorithms

Dennett's book should be read, if for no other reason, than for its excellent treatment of what algorithms are all about. Here are the features of algorithms that

Dennett lists (this summary does not do justice to the skillful ways he uses the features in his arguments):

(1) *substrate neutrality*: The procedure for long division [for example] works equally well with pencil or pen, paper or parchment, neon lights or skywriting, using any symbol system you like. The power of the procedure is due to its *logical* structure, not the causal powers of the materials used in the instantiation, just so long as those causal powers permit the prescribed steps to be followed exactly.

(2) *underlying mindlessness*: Although the overall design of the procedure may be brilliant, or yield brilliant results, each constituent step, as well as the transition between steps, is utterly simple. How simple? Simple enough for a dutiful idiot to perform—or for a straightforward mechanical device to perform.

(3) *guaranteed results*: Whatever it is that an algorithm does, it always does it, if it is executed without misstep. An algorithm is a foolproof recipe. (pp. 50–51)

Dennett then ties these features of algorithms to the mindless genius, if you will, of natural selection. He proposes that, "the [blind] algorithmic level *is* the level that best accounts for the speed of the antelope, the wing of the eagle, the shape of the orchid, the diversity of the species, and all the other occasions for wonder in the world of nature" (p. 59). [And, we'll see how this would include Dennett's book itself in a moment.]

Evolutionary Design Space and Memes: Dennett's Synthesis

After Darwin, Dennett's presentation of the awesome power of natural selection draws most heavily on the work of Richard Dawkins, especially, *The Selfish Gene* (1976, 1989), and *The Blind Watchmaker* (1986). Dawkins is cited 51 times, once every ten pages. I point this out, not as a criticism, but to illustrate the level of Dawkins' influence. In my view, Dennett does a wonderful job of taking Dawkins' concepts to new horizons. If you liked the above works by Dawkins, as I did, I recommend *Darwin's Dangerous Idea* highly.

Dennett borrows two of Dawkins' most powerful evolutionary conceptions, namely, evolutionary design space and memes, in order to explore a full story of design by natural selection. Dawkins' notion of evolutionary design space can be thought of "as a mathematical 'space,' an endless but orderly vista of morphological variety, but one in which every [potential] creature is sitting in its correct place, waiting to be discovered [or actualized via natural selection]" (1986, p. 66). Evolutionary design space, then, is an imaginary space (extendable to an n-dimensional space that cannot be visualized) of "creature-coordinates" that over time would reveal all potential morphological pathways among all potential creatures, a trivial portion of which become actual. Dawkins proposed the idea of *memes* as units responsible for the transmission of culture that have similar functions in culture to those that genes have among biological systems. Memes were conceived by Dawkins as a cultural-level derivative of his concept of Universal Darwinism: "all life [no matter where in the universe, or what its form might be] evolves by the differential survival of *replicating* [italics added] entities" (1976, p. 206). [See Dawkins (1983) for the complete description of Universal Darwinism.] By extension of this idea, Dawkins (1976) proposed memes as cultural-level replicators:

Examples of memes are tunes, ideas, catch-phrases, clothes fashions, ways of making pots or of building arches. Just as genes propagate themselves in the gene pool by leaping from body to body via sperm or eggs, so memes propagate themselves in the meme pool by leaping from brain to brain via a process which, in the broad sense, can be called imitation. If a scientist hears, or reads about, a good idea, he passes it on to his colleagues and students. He mentions it in his articles and his lectures. If the idea catches on, it can be said to propagate itself, spreading from brain to brain. (p. 206)

Dennett enlists Dawkins' two concepts of evolutionary design space, and memes as the bases upon which to elucidate further a *unified* way of imagining not only the evolution of creatures, but also a parallel evolution of culture and the human mind, "*there is only one Design Space, and everything actual in it is united with everything else* [Dennett's italics]" (p. 135). He later provides an enfleshed summary of this view:

If this [unified design space idea] is right, then all of the achievements of human culture — language, art, religion, ethics, science itself — are themselves artifacts (of artifacts of artifacts . . .) of the same fundamental process that developed the bacteria, the mammals, and *Homo sapiens*. There is no Special Creation of language, and neither art nor religion has a literally divine inspiration. If there are no skyhooks [magical forces] needed to make a skylark, there are also no skyhooks needed to make an ode to a nightingale. No meme is an island. (p. 144)

So, Dennett proposes that, through the relentless plodding of the natural selection algorithm, gene and meme evolutions traverse and actualize in the *same* design space. Dennett cites intriguing descriptive parallels between what genes do in biological systems and what memes do in cultures. I think Dennett (and, in all fairness, Dawkins) is on the right track. And, I have described mechanisms for an algorithmic-level evolution of culture, including mathematics (Vandervert, 1993). However, when it comes to comparing memes with genes, there is at least one monstrous question that begs to be addressed.

Genes are Memes

There is a fundamental contradiction inherent in referring to genes as one thing, and memes as a whole new category of things that are *much like* genes. The problem is that genes themselves actually belong to the category of memes. Genes are memes. This whole situation started, of course, with Dawkins (1976) who originally missed the gene/meme "incest" problem.

It is puzzling that although Dennett provides the following sample list of memes, he doesn't take notice of the problem: "arch, wheel, wearing clothes, vendetta, right triangle, alphabet, calendar, the *Odyssey*, calculus, chess, perspective drawing, evolution by natural selection, impressionism, 'Greensleeves,' deconstruction" (p. 344). Why didn't he add algorithms and genes to the list? *All* of these are examples of cultural-level mental models. So when Dennett (and Dawkins) describes memes in terms of genes, he is actually describing one mental model on the basis of another. The problem is, which is the more fundamental, the meme, "gene," or the meme, "meme?" Which is the more fundamental algorithm, cultural evolution or biological evolution? One might rejoin with something like, "Oh, but genes are better understood at the empirical level, so they're more fundamental." I can only invoke the spirit of Karl Popper's (1972, chapter 7) "hypothetical realism" here; no hypothetical meme for genes, no genes.

Where Lives the Beauty of the Eye?

The foregoing situation reminds me of a similar problem where adaptionists Tooby and Cosmides (1992) were struggling to defend the idea that specifically-human adaptations (like language) are at least as refined as, for example, the eye. Tooby and Cosmides might have recognized that only the human can model and know about eyes, and the human is able to do this only via the evolutionary sophistication of its specifically-human symbol systems of mathematics and language—in short, via *memes*. The entire idea of the classical sophistication of the eye, is not given by the eye itself, but by an even more sophisticated "meme-dimensionalizer," namely, the human brain's unsurpassed natural beauty as a symbol system manipulator. Expressed another way, it seems that the page of text that has the capacity to describe the "evolutionary beauty of the eye" must somehow be more beautifully refined than the eye itself. (Because they have little or no culture [no memes], Chimpanzees, for example, cannot mentally model the beauty of the eye.) So, when evolutionary refinement is defined in terms of the algorithmic power of discernment in the broad sense, the human-specific capacities for language and meme generation are more refined than the eye.

The point of the above little story is, again, that since memes include all ideas, we can't give cultural-level birth to anything except in the form of memes. So, going back to Dennett (and Popper), the question remains, how can we determine the algorithmic relationship between design by gene, and design by meme? Is the meme design space like the gene design space, or is it actually the other way around? Or, are we faced with some sort of algorithmic transformational transparency (see the *substrate neutrality* feature of algorithms) across design spaces that binds them together in a seamless web wherein it makes no difference?

The Beast Is Beauty?

The above story about the beauty of the eye has another purpose in this review. In his final paragraph, Dennett concludes that Darwin's dangerous idea might be viewed either as a Wolf in Sheep's Clothing, or as the beast in "Beauty and the Beast." The view he defends throughout the book is that "the Beast is, in fact, a friend of Beauty, and *indeed quite beautiful in its own right* [italics added]" (p. 521). That the beauty of the eye is *in* the text that describes it, is this reviewer's way of applauding Dennett's articulation and defense of the magic that is immanent in the "wonderful wedding of chance and necessity" (p. 520) of Darwin's idea. I wholeheartedly recommend reading the book, and, as Dennett suggests in closing, "You be the judge" (p. 521).

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