Daniel C. Dennett. *From Bacteria to Bach and Back: The Evolution of Minds*. W.W. Norton & Company 2018. 496 pp. $18.95 USD (Paperback ISBN 9780393355505).

This book is Dennett's latest attempt to naturalize the mind by providing 'one long argument,' a just-so story of the evolution of minds – from Bacteria to Bach, as the title suggests. But more exactly, it's the story of the evolution of evolution, taking us from the proto-Darwinian processes of the pre-biotic world (chapters 2-3) to the biological evolution of living and intelligent forms (chapters 4-5), to the cultural evolution of our past and present (chapters 6-13), and so the emergence of (*our* kind of) comprehension and consciousness (chapter 14) to some closing speculations on the near-future of 'post-intelligent design' (chapter 15) – with excursuses on information, memetics, and the origins of language (chapters 6, 9-11, and 12, respectively).

The book's fifteen chapters are divided into three parts, and their order recapitulates the historical progression just noted. After introductory remarks on some of the key ideas to be met in the book (chapters 1-2), the book begins, therefore, at the beginning – or near enough.

In the beginning, there was a world of energy in flux. But not all was chaos. There were relatively stable patterns of varying complexity. For there were contemporaneous and overlapping (even if asynchronous) cycles at various spatiotemporal scales producing patterns combining with patterns to produce further, more complex patterns (44). But in the world before life and intelligence, none of this was *for* anything. And the same goes for many patterns in the present.

Take the stone circles of Spitsbergen. They *look* designed, like intentional products, as if they are there for a reason, or serve some purpose. But as Kessler and Werner demonstrated (cf. *Science* 2003), a simple algorithm with parameters for stone size, soil moisture and density, etc., suffices to explain how mere cycles of freezing and thawing produce these patterns (44-5). There is no need to ascend to the 'intentional' or 'design stance.' For here there is no answer to the question *Why?* in the sense of *What for?* For such phenomena, the only answers *why* tell us *how come*. The 'physical stance' suffices (37-8).

We don't know what 'suite of processes … led to the origin of life' (43). But we know enough to 'dissipate … the fog' (43). A suite of processes gradually, by way of compounding products of processes of ever-greater complexity, led first to proto-life forms and then to life forms. The key word is *gradually*.

There is no 'bright line' marking the difference between non-life and life, and there is a continuum of processes from the non-Darwinian to the Darwinian. But with the eventual emergence of life, we move from the 'differential *persistence*' of the products of the processes of the abiotic world to the 'differential *re-production*' of the biotic (47). And with populations of reproducers (replicators), the members of which exhibit variation in heritable (replicable) characteristics, leading to differential rates of reproduction (replication) in their selective environments, we have the process of evolution by natural selection (138). Biological evolution is the first case in point, and here the adaptationist story picks up.

Among the patterns in the flux, some are 'differences that make differences' to organisms of one kind or another, evolved by natural selection to be selectively sensitive to (at least some of) these patterns – 'real patterns' (222), or discernible 'signals in the noise' (116-7, 124). These patterns (which carry 'semantic information,' i.e., information *about* something, for those who discern them) constitute an organism's world, or Umwelt (79). They are things (in the broadest possible sense of the term) that matter to the organism (78-9, 128, 366), and a list of them provides its ontology (60).

These things making up the organism's ontology are again differences that make differences to the organism, and that is to say: they are its 'affordances,' or that with respect to which it gets

around in and copes with the world in which it is embedded (79, 101, 128). Being sensitive to these things is adaptive; and blind, aimless evolution by natural selection (which is no agent and a fortiori no designer) accordingly hits upon the appropriate designs – 'designs without designers' (36-7). It was Darwin's 'strange inversion' that allowed us to see how this is possible (56-8).

Organisms, as formed by natural selection, are composed of (interlocking systems of) organs for detecting various differences that make differences to them; and detecting these differences (real patterns carrying semantic information) thus constitute the reasons for the organs, which endow the organisms with competences in turn enabling them to get around in and cope with their environments. Importantly, not all organisms need comprehend all these competences. There can be 'competence without comprehension' (75). Showing how this is possible, even with sophisticated information-processing behaviours, was Turing's strange inversion (55-8).

In fact, the vast majority of organisms have any number of often very striking competences and no comprehension whatever (87, 336). They need not represent (to themselves), and so *have*, the reasons for which they are as they are and do as they do. There is a reason for the butterfly's eye-spots, the antelope's stotting, and the beavers' dam, though the butterfly *et. al*. need not appreciate these reasons (74-94, 101). Dennett calls these unrepresented reasons 'free-floating rationales' and insists that the world of life, even before intelligence, is saturated with these reasons (along with designs and purposes) (35-8) – reasons uncovered by the reverse-engineering perspective of the design stance; reasons that answer the question *Why?* in the sense of *What for?* (39, 92).

Where along the scale of complexity, from bacteria to Bach, do we first find organisms that (*really*) have the reasons for which they act? What is the simplest organism toward which it is right to take the intentional stance? When did comprehension first emerge? Dennett refrains from answering these questions, and on principle: The evolution of forms of ever-greater complexity is a gradual process and its products lie on a continuum. Competence and comprehension, like complexity, come in degrees. But increasing competence eventually yields comprehension and consciousness – with the clearest cases of both, *our own*, being evolutionary latecomers.

The behavioral competences of some organisms ('Darwinian creatures') are fixed by biological evolution. In others ('Skinnerian creatures'), learning picks up where biological evolution leaves off (89). Still more sophisticated organisms ('Popperian creatures') try out 'hypotheses' before acting. And for organisms embedded in a culture ('Gregorian creatures'), a niche replete with 'thinking tools,' cultural evolution supplements biological evolution (98-9). Cultural evolution, according to Dennett, is the key to explaining the marked differences between our species and our closest kin.

As genes are the units of selection (the replicators) in biological evolution, memes are the units of selection (the replicators) in cultural evolution. They are 'ways of behaving' – doing, making, saying, thinking – that are replicable and transmissible *perceptually*, not genetically (206). These *ways* can be anything from song and dance to gesture and language. Words are the paradigm meme – 'pronounceable memes,' as Dennett defines them (207) – and they are indeed among the best memes. The digitality of language, being composed of words, allows for high-fidelity replication and transmission of memes, which in turn allows for the accumulation of culture (330-1).

As language-wielding Gregorian creatures embedded in the niches of our cultures, we are inducted into practices of giving and asking for reasons (for our actions, attitudes, etc.), which bind together the communities of which we are members (314-5). We are indeed inducted into this practice *in learning a language*, which encodes an interpretation of the world of our affordances, or what matters *to us* (61).

We represent to ourselves the ontology of affordances making up our Umwelt, and these representations, too, become part of our Umwelt (and so affordances to be represented) (340) –

indeed, *we* and our reasons, which we represent to ourselves, are part of this Umwelt. It is in this way, on Dennett's view, that comprehension and consciousness, including *self*-consciousness (and selves, to the extent that things with selves *have* selves), emerge together (343-4).

For us, the world of our affordances is our manifest image – the world as it appears to us. But science seeks to move 'beyond' the appearances to the 'underlying reality' – the world as it is *in itself*, not as it is represented *for us*. And here lies the problem for a naturalistic, and so scientific, account of mind. For the phenomenon of mind, and consciousness in particular, appears essentially tied to subjects with first-person perspectives on the world. On a common view, the reality of consciousness, with all its intrinsically qualitative features, *just is* its appearance to subjects; and the scientific image, the contents of which are described from the third-person perspective, must leave this out.

But appearances, Dennett reminds us, can be misleading. 'Cartesian gravity,' as he puts it, distorts our thinking (364-70). In a final, strange inversion of his own – what he calls Hume's strange inversion – Dennett claims that the affordances in our manifest image, including ourselves (read: our *selves*) and all the contents of our consciousness are 'user-illusions' (222-3, 368).

The view will strike many as incredible – in fact, incoherent. Indeed, incredible *because* incoherent (Illusions *for whom?* And aren't the illusions *something*?) – not to mention in tension with the apparent realism about real patterns for most of the book *up to* the discussion of consciousness. Even if the view can be worked out coherently, the chosen metaphor of user-illusions—the primary example being icons on a desktop computer (347)—will be seen to be unhelpful. On Dennett's view, there is no screen and no user – they, too, are illusions (346-7, 353). Can't imagine it? 'Try harder,' says Dennett (360, 369-70).

And try we should. This book rewards reading and rereading even where most unconvincing.

David Lindeman, Johns Hopkins University