

Daniel C. Dennett

*Shall We Tango?  
No, but Thanks for Asking*

I have learned a lot from Evan Thompson's book — his scholarship is formidable, and his taste for relatively overlooked thinkers is admirable — but I keep stumbling over the strain induced by his self-assigned task of demonstrating that his heroes — Varela and Maturana, Merleau-Ponty and (now) Husserl, Oyama and Moss and others — have shattered the comfortable assumptions of orthodoxy, and outlined radical new approaches to the puzzles of life and mind. The irony is that Thompson is such a clear and conscientious expositor that he makes it much easier for me to see that the ideas he expounds, while often truly excellent, are not really all that revolutionary, but, at best, valuable correctives to the sorts of oversimplifications that tend to get turned into mantras by sheer repetition in the textbooks and popular accounts of these topics in the media.

Philosophers have a delicate task: squeezing the tacit assumptions and unnoticed implications out of every ill-considered dogma without lapsing into nitpicking or caricature. Thompson does better than most; he is not a *gotcha!*-monger or sea lawyer, but he does set up a few strawmen (strawpersons?) which I will duly expose as such, while showing that his revolutionaries are not really so revolutionary after all. Reformers are the bane of would-be rebels, of course, taking the wind out of their sails just as they get started, and in the cases I will discuss, reform-minded critics — myself among them — have already pointed out the caveats that pre-empt these assaults on orthodoxy. Might these caveats and concessions be mere lip service? Have the reformers underestimated the seriousness of the challenges, papering over the cracks that will in due course bring down their edifice?

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Perhaps, but that case remains to be made, and it must begin by acknowledging that the problems have not gone unnoticed, just — at worst — underestimated.

I will concentrate on four themes in the book, since they all involve my own work in one way or another:

1. autopoiesis as a radical new foundation for evolutionary theory (in contrast to the ‘Ultra-Darwinism’ he attributes to Dawkins, Maynard Smith and me),
2. developmental systems as an alternative to ‘genocentrism’, adaptationism and my *design stance*,
3. the ‘autonomous’ view of semantic information (as contrasted with my intentional stance, among others),
4. the first-person methodology he opposes to my heterophenomenology.

(Thompson also discusses my role in the mental imagery debate between Kosslyn, Pylyshyn and others, but in the interests of brevity, I will postpone comments on that for another occasion.)

### 1. Autopoiesis

Is there a ‘theory of autopoiesis’ (p. 97),<sup>1</sup> or is it just a good way to think about the requirements of life? I’ve been struggling with the idea of autopoiesis off and on for many years, since first meeting Umberto Maturana and Francisco Varela. Thompson succeeds in making the idea of autopoiesis as clear as anybody could want. The upshot, however, is that autopoiesis turns out to be, well, the *cell theory*, made a little deeper and more general by being divorced from the particularities of biochemistry and reduced to its simplest specifications. A similar — indeed virtually synonymous — approach is the *chemoton* proposed by Tibor Gánti (1971, but available in English only since 2003), the minimal functional/structural requirements for a living, metabolizing, reproducing organism (autopoiesis treats reproduction as an option, not a necessary condition, of life). I don’t see anything in autopoiesis as limned by Thompson that would upset — or particularly inform — a mainstream cell biologist, aside from the fancy language in which the specs are couched. As Thompson says, ‘The paradigm [of an autopoietic system] is a living cell’ (p. 44). The cell theory is, so far as I can tell, good biology indeed, so I have no

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[1] Unless otherwise indicated, all page numbers in the text refer to Thompson (2007a).

quarrel with it at all. In fact I rather like some of the formulations due to Maturana and Varela, and some of Thompson's as well, such as 'a cell stands out of a molecular soup by creating the boundaries that set it apart from what it is not' (p. 99), which nicely draws attention to the fact that the concentration of large molecules outside a cell is not all that different from that inside. The cell's boundary is its most salient and robust feature but there are exceptions to Thompson's claim: the boundary is, as everybody notes, semi-permeable, and which things count as inside and which as outside is not always clear. There are transition zones, and besides, is something inside it food, waste, or a proper part? If it too is an autopoietic system, is it an invader or a symbiotic ally?

So far as I can see, autopoiesis is an excellent summary of what it takes for a collection of molecules to be alive, but it doesn't predict anything in biology that hadn't already been well understood by earlier theorists, or dissolve any puzzles that had been bedevilling those theorists. Thompson clearly disagrees with this bland verdict, and articulates his disagreement with a series of what I will call *ratherings*. A rathering is a rhetorical move much beloved by some of the other ideologues of biology, such as Steven Rose and the late Stephen Jay Gould. The general form of a rathering is 'it is *not* the case that blahblahblah, as orthodoxy would have you believe; it is *rather* that suchandsuchandsuch — which is radically different'. Some — not all — ratherings are little more than sleight-of-hand, since the word 'rather' implies — without argument — that there is an important incompatibility between the claims flanking it. I counted over a dozen ratherings, and six of them occur on two adjacent pages, 206 and 207. Sometimes Thompson eschews the word 'rather' and settles for the slightly terser 'not... but...' idiom. A case in point:

Such systems need to be seen as sources of their own activity, specifying their own domains of interaction, not as transducers or functions for converting input instructions into output products. (p. 46)

Why can't they be seen as both? And don't we need a small loophole to allow that autopoietic systems specify their own domains of interaction *when all is going well*? (A similar concern affects Varela's 'Closure Thesis' discussed on p. 48.)

I like the recognition by the autopoiesis view that replication (e.g. DNA replication) could be an optional add-on. After all, mules are certainly alive and cannot replicate. Interestingly, mules can be seen as a curious sort of ecto-parasite, dependent on us (on mule-fanciers, more particularly) to maintain their numbers. Other kinds of

intermediate cases could also be listed. In short, we see many variations on (or exceptions to) autopoiesis in nature. Chemotons are autopoietic systems with replication. Autopoietic systems are viruses with a metabolism (*cf.* p. 104). Just as a hermit crab can acquire its shell instead of ‘self-producing’ it, a proto-living form can acquire its membrane in a similar way (this is a currently well-regarded conjecture about the origin of life, discussed by Thompson on pp. 113ff). Is Gaia an autopoietic system? As Thompson notes (pp. 121ff), this isn’t clear.

Autopoietic systems, as defined by Thompson (following Maturana and Varela), are perhaps owed pride of place in the cornucopia of life because of their ‘autonomy’, but even this feature is, as Thompson notes, ‘a “heuristic notion” — so whether a system is autonomous is context-dependent and interest-relative’ (p. 50). And it is worth noting that non-autonomous systems often display key features of life and cognition. For instance, my *intentional systems* are predictable and explicable from the intentional stance whether or not they are autonomous systems, or proper parts of autonomous systems, or fully heteronomous. Even if one granted that *autopoiesis* is the most apt definition of the property of *life*, this would not establish that only autopoietic systems can be the proper (literal, underived, etc.) bearers of various biological predicates. After all, viruses are not alive, are not autopoietic systems, and yet the theory of evolution by natural selection applies as truly and unmetaphorically to them as to any living thing. Recently severed limbs, and transplantable kidneys and hearts, are *living*, but not themselves autopoietic systems, and so forth.

Then there is the major question of whether autopoiesis provides a genuine alternative to standard neo-Darwinism (or ‘Ultra-Darwinism’, the term invented by Stephen Jay Gould — along with ‘Darwinian Fundamentalism’ — to try to reposition his own misgivings in the centre of the field; a term adopted, I’m sorry to say, by Thompson). Here the ratherings come in droves: ‘natural selection is not an external force but the differential propagation of developmental systems’ (p. 202). An ‘external’ force? Thompson repeats this charge at least three times, but just what mistake is it, and what evidence is there that anybody ever makes it? He quotes a rathering from Levins and Lewontin: adaptationism ‘implies that the organism is simply a passive object of selection rather than an active agent or subject of the evolutionary process’ (Levins and Lewontin, 1985). How does this implication run, and does anybody believe it? Thompson dismisses Dawkins’ concept of arms races, one of the most predictively fruitful insights in evolutionary biology, as ‘merely a questionable metaphor’

(p. 205). This dismissal would be more persuasive if Thompson could show us a single instance in which autopoiesis (or developmental systems theory) has predicted or explained biological effects on a similar scale. Finally, Thompson says, regarding my claims about biology as reverse engineering:

To move from the claim that organisms can be interpreted from a reverse engineering stance to the claim that they are artifacts of design is to confuse a particular heuristic or interpretive framework with the phenomena themselves. (p. 211)

Since I have gone to considerable lengths over the years to show how ‘design-without-a-designer’ is no more a contradiction in terms than ‘splittable atom’, and since I have demonstrated over and over how the design stance works exactly as well for organisms and their parts and behaviours as it does for artefacts, I find this charge of elementary confusion on my part, presented with no support at all, simply incredible. Consider that Gánti and Maturana arrive at similar models for similar reasons: Gánti began his career as a chemical engineer and is explicit about his reverse-engineering perspective in chemoton theory; Maturana does not highlight the reverse-engineering in his approach, but Thompson’s own excellent clarification of the idea of autopoiesis nicely reveals its functionalistic rationales.

## 2. Developmental Systems

The claim here is that ‘Ultra-Darwinism’ with its ‘genocentrism’ must be ousted and replaced by an ‘enactive’ vision of biology — and evolution — that is profoundly unlike orthodox neo-Darwinism. Thompson is not the only thinker tempted to declare that ‘evo-devo’ overthrows — *rather* than enlarging and repairing — the neo-Darwinian synthesis, but like the others he relies on something of a caricature of the genocentrism he seeks to banish.

In particular I am unimpressed by the claims he makes about the ‘dualism of hardware and software’ which he imputes to genocentrism (e.g. pp. 174, 185), and ‘the myth of the gene as a unit of pure information’ (p. 179). First of all, I take it that he is not claiming that the hardware/software dualism of *computer science* is dualism of any objectionable (e.g. Cartesian!) kind. It is about as secure and useful as any ‘dualism’ in science (e.g. matter and anti-matter, or — closer to home — living and non-living). So it must be something about the way this useful and well-understood dualism of computer science is (mis-?)applied to genes that is the problem, but Thompson never spells this claim out. Some sciencephobes have used the epithet

‘dualism’ somewhat ironically (one supposes) to attack any science that uses the concept of information, as if the criticisms of Descartes’ brand of substance dualism could be somehow harnessed to their campaign against the use of computer science concepts in the humanities! I hope Thompson is not following their lead, but then I don’t see what he is saying. There seems to me to be a very clear and unobjectionable way in which we can draw the software/hardware distinction when discussing genes: the DNA molecule has an architecture that is ideally suited for enabling the replication of sequences of codons. These sequences, like software, are composed from a finite alphabet of salient and discriminable units, with the information carried by the particular sequence of codons so that scrambling them destroys the information. (The same is of course true of texts: shredders destroy the usable information in them by making the sequences unrecoverable.) Moreover, to a first approximation, thanks to the brilliant work of the molecular biologists since Crick and Watson set this investigation in motion, we can now show how these sequences, when fed into the machinery — the ribosomes, mainly — within the cell, yield proteins (and other effects). Like so many products spewing out of a CAD-CAM system in response to the specification — the information — provided as input. No whiff of objectionable dualism can be discerned here, I think.

As for the ‘myth’ of the gene as a ‘unit of pure information’, I wonder if anybody has ever subscribed to that myth. Here is another rathering:

Information is not intrinsic to the linear array of the DNA sequence. Rather, it is constituted in and by the cell as an autopoietically organized, three-dimensional entity — by the cell as a *body*. (p. 182)

Presumably Thompson would agree with this as well:

Information is not intrinsic to the linear array of the letter sequence in a book. Rather, it is constituted in and by the reader as a cognitively organized, three-dimensional entity — by the reader as a *body*.

I take it everybody recognizes that the sentence ‘Snow is white’ only carries information about the colour of frozen precipitation on the assumption of the whole world of English speakers and readers. It carries no information at all *intrinsically*. Similarly, genes carry information only within the larger system of gene-readers, gene-recipe-executors, etc., etc. I doubt that any ‘genocentrist’ has ever thought otherwise. No myth here. Thompson cites a passage of mine making roughly this point, but goes on to claim that I cannot draw a ‘principled line... between explicit (coded) and implicit (uncoded) information’ (p.

184). Quite frankly I don't see the problem, and have gone on at considerable length about the difference in various places. I may be wrong, but Thompson doesn't address my claims, relying instead on a passage quoted from Oyama, itself a series of non-sequiturs.

Thompson says 'It is simply not true that genes are prime-movers and cells their vehicles', citing Moss (2003) as his authority. Moss's argument isn't given, and although I am sure there are flat-footed senses in which this is 'simply not true', there are others where it is not at all obvious that this isn't true. We know that tiny changes in genes can yield huge downstream effects in population characteristics, ecological dynamics, large morphological changes (compare two branching lineages from a common mammalian ancestor: ungulates with hooves and whales), while similar changes in somatic line cells seldom result in amplified differences. Yes, 'molecular biology can lose sight of the organism as a whole' (p. 93), as Rose and Goodwin have argued, but while nobody can doubt that this is often true, few would agree with Rose or Goodwin that this is a disqualifying flaw in neo-Darwinism. In his campaign against orthodoxy, Thompson cites a veritable Hall of Fame of the would-be revolutionaries of biology, from such warhorses as Levins and Lewontin, Margulis and Sagan, and Lovelock, to Kauffman, Keller, Oyama and Moss. This is a rhetorical strategy that can backfire. It caused me to conclude that if, throwing the kitchen sink at orthodox neo-Darwinism, this is the best Thompson can come up with, neo-Darwinism is in pretty good shape. Not all critics of neo-Darwinism are equal, and a more persuasive argument would concentrate on one or two main points and develop them in detail. Maybe one of Thompson's radical biologists will prove, in the long run, to be right, but they haven't individually made much of a dent on orthodoxy so far, and pooling them into chorus doesn't persuade me, and won't persuade many others, even if it ought to.

### 3. Autonomous Meaning-Construction

Thompson insists on 'the distinction between autonomous meaning-construction and heteronomous information processing' (p. 54), but once again, I think we have a case of rathering here:

From an autonomy perspective, individual neurons do not detect objectively defined features. Rather, assemblies of neurons make sense of stimulations by constructing meaning, and this meaning arises as a function of how the brain's endogenous and nonlinear activity compensates for sensory perturbations. (p. 53)

Why not both? Thompson seems to think that the autonomy perspective permits the theorist to allow the neurons to do the sense-making,

while in all versions of the alternative perspective ‘an observer or a designer stands outside the system and states what is to count as information’ (p. 52). This is reminiscent of Gerald Edelman’s (1989) insistence that his neural Darwinism does not count as a computational or AI model because the meaning of the (semantic) information in his simulations is not given in advance by the world, or by the modeller. But this is a red herring. Indeed, most AI systems devised so far have been built-to-order to represent certain states of affairs in the world defined by the system’s users, but this is obviously an optional matter. If an AI is designed (as some are, such as Edelman’s, but not only his) to muck about in the world and devise their own categories, the charge is vacated. As I and others have argued, all meaning in organisms is constructed by self-regarding processes that gerrymander the ‘given’ categories of physics to suit their purposes. This idea has been around for a long time, in Sellars’ distinction between the scientific image and the manifest image, for instance, and in Quine’s discussion of biases in the property-spaces of living things. Still, as an observer, one can in principle identify the categories adopted/constructed by an organism objectively — such as the categories of the sweet and the cute, the sexy and the ugly — once one understands in detail the evolutionary/ecological predicament of the organism in question. In fact, Thompson quotes at length from my own account of this (p. 160) and then adds: ‘This passage could easily stand as a gloss on what I have been calling sense-making.’ The difference, he notes, is that his version is based on autopoiesis and mine on selfish-gene theory. That counts against my version only if selfish-gene theory is in error, which Thompson fails to show, but in any case it belies the rathering quoted above: the ‘autonomy perspective’ is not required for making sense of sense-making. I say that agency is born ‘in the first macromolecules that have enough complexity to “do things”’. Thompson points out, truly enough, that such macro-molecules cannot exist without being parts of autopoietic systems, but still they are agents, even if not fully autonomous. Think of motor proteins — little porters trudging along on their actin or tubulin highways carrying freight to where it is needed. Think of proof-reading enzymes.

One of my favourite quotations from Maturana in the book is this: ‘Living systems are cognitive systems, and living as a process is a process of cognition. This statement is valid for all organisms, with and without a nervous system’ (1970, quoted on p. 124). Indeed, and the cognitive processes (in this somewhat extended sense of ‘cognitive’) that even bacteria and their proper parts engage in can best be appreciated from a reverse engineering perspective: there must be

transducers that detect the life-relevant conditions and effectors that are appropriately linked to those transducers so that the ‘self-producing’ prowess of the autopoietic system can be maintained and enhanced. (See the excellent book by Dennis Bray, *Wetware*, 2009, for a lucid discussion of the computational networks of molecules in bacteria and other unicellular life forms.)

#### 4. First-Person Phenomenology vs. Heterophenomenology

Thompson lists five criticisms of heterophenomenology.

First, it is wrong, he claims, for me to look for confirmation or disconfirmation of subjects’ heterophenomenological reports by discovering processes occurring in their brains. ‘One is describing one’s subjectivity at the personal level in a way that is completely noncommittal about the subpersonal workings of one’s brain’ (p. 305). Right he is, and I have not forgotten or abandoned the personal/subpersonal level distinction, which I introduced (1969), so I am quite alert to this point. I go out of my way to explain that subjects’ convictions about, or commitments about, what is going on in their brain are simply not part of the heterophenomenological data. People have all sorts of bizarre theories about what they are talking about and I am looking at what might be called *unwitting reference*. That is why we need to adopt the peculiar agnosticism recommended by heterophenomenology (at least a close kin to Husserl’s *epoché*); but once we have gathered our heterophenomenological story, it is time to start theorizing and experimenting, and *that* is where we find the leverage to discover that, for instance, *since* there are no images being processed in the brain when subjects say they are rotating mental images, their heterophenomenological reports must be interpreted as unwitting fictions of a sort. (For more on this see my response to Schwitzgebel, 2007, in Dennett, 2007.)

Second is a point about intentional acts that I don’t understand: ‘From a phenomenological standpoint, however, there is no such thing as an intentional or notional object without a corresponding intentional act, and intentional acts are not to be identified with beliefs’ (p. 305). This must be a special, phenomenological meaning of ‘intentional acts’ since manifestly there are intentional objects without intentional acts in the everyday sense. Your misidentification of the tree stump on the side of the road as a pedestrian was not an intentional act, but it creates an intentional object. And although the process (jumping unconsciously to a conclusion, or whatever we call it) that creates this intentional object is not itself a belief, it generates a

belief — perhaps fleeting — to the effect that there is a pedestrian out there. I wonder what I am missing.

Third, Thompson describes the ‘unavoidable need to make use of first-personal modes of access to mental phenomena’. I don’t deny that. This objection is a red herring. Heterophenomenology is advertised by me as the way — the best way — of taking first-person data seriously within the third-person domain of cognitive science; that is why I went into considerable detail about the ways in which we can transform first-person modes of access into (usable) third-person sources of data by proper scientific method. Still, Thompson avers, ‘Nothing in heterophenomenology would lead it to envision — let alone take the step — of working with experience in this direct phenomenological way’. On the contrary, the whole point of heterophenomenology is to give the subject the best possible opportunity to let it all hang out, in effect, to tell the world about what it is like to be that subject! It just requires, as all science does, that there be interpersonal standards of data-gathering.<sup>2</sup> To the extent that Lutz *et al.* (2002), the flagship attempt at a first-person methodology for studying consciousness, does not meet these standards, it has been quite appropriately criticized (see, e.g. Piccinini, 2010).

Fourth, ‘to take statements about experience as expressions of beliefs about experience seems strained’ (p. 307). How so? It ‘over-intellectualizes’ the experience and ‘runs the risk of overinterpreting subjects, thereby distorting their experience’. This objection actually supports what it sets out to criticize. Suppose a Turkish subject says (what seems to English observers to be the sentence): ‘I’m rotating the left image clockwise.’ We will have no way of using this raw datum at all if we can’t interpret this as an expression in English of his current belief (or his expression, in Turkish, of some other belief that just happens to sound like the English sentence!) We can’t let subjects’ expressions count as evidence for their conscious experience — aside from utterances like ‘Ouch!’ and ‘Ahhhhhh!’ — without interpreting them as propositions asserted in some language, and sincerely asserted at that; in other words as utterances expressing their current beliefs. Thompson goes on to say that my proposal ‘collapses the crucial distinction between conscious experience and belief about conscious experience’ (p. 307). He suggests that ‘pervasive moods’ and ‘rapid and transient emotional experiences’ are experiences we don’t believe we have but ‘First-person and second-person methods work

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[2] Thompson’s claim here was first presented in Thompson (2007b) and responded to by me — in somewhat more detail than here — in Dennett (2007).

directly with these sorts of experience and thus do indeed garner more usable data than heterophenomenology does' (p. 308). Perhaps, but since Thompson doesn't say how these methods accomplish this, we will have to wait for a verdict. An example of such a method in operation would be most helpful.

Fifth, he says that 'heterophenomenology is no mere extension' of ordinary science because it involves using the intentional stance. Thus it stands in 'an interpretive, intersubjective, and interpersonal relation to its subject matter'. Indeed. That makes it very different from chemistry and biology — we don't have to whisper when experimenting with proteins for fear of their learning what we hope to discover. That is why I went to all the trouble to show that in spite of its being interpretive, we could achieve usable levels of intersubjective agreement on the part of experimenters — availing ourselves of the standard techniques of double-blind experimentation with independent scoring, etc. Instead of having to be hidebound behaviourists, eschewing all verbal interactions with our subjects, we can use language rigorously and cautiously to get at what it is like to be them, by asking them (second-personally) and letting them tell us (from the first-person point of view). Thompson says in the end that heterophenomenology, by relying on these 'second-person' methods, is not strictly speaking a third-person method. Perhaps, then, what he should next acknowledge is that his own proposed method is really heterophenomenology after all *rather* than a radical alternative. If he will adopt my method, I will adopt his name for it: second-person heterophenomenology.

Let me close with a limited defence of setting up strawmen! Think of a dance instructor, who, seeing her pupil unwittingly doing something slightly awkward, says 'You're doing *this!*' — and produces an hilarious parody of the poor student's ungainly move. Ouch! Unfair! But probably a very good way, and maybe the only way, of getting the student to notice an unrecognized weakness in her dancing. Now consider what Thompson has done: he sees — or thinks he sees — that contemporary evolutionary biologists and cognitive scientists (and some philosophers thereof, *e.g.* me) are all too comfortable with the oversimplifications they have learned to love, and tend to overlook or underestimate important complications that would actually enrich their understanding of the phenomena they are dealing with. How to get them to notice? Poke them in the eye with a parody! The tactic can backfire, of course, and leave everybody grumpy, but a more constructive response is to take the criticism to heart, note, for the record, the misrepresentations in the challenge, and say 'Thanks, I needed

that!' Such a response co-opts the revolutionary, turning him and his heroes into mere reformers, but such is life. Thompson would love to get us all to dance the tango, but — speaking for myself — it ain't gonna happen!<sup>3</sup>

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[3] Yes, I know, the tango is from Argentina, not Chile, but since neither I nor the rest of the world knows of a national dance of Chile that has the passion and drama of the tango, I have to settle for this readily understood metaphor, with apologies to all my Chilean friends.