

Sentience, Awareness, Consciousness

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Abstract: The paper starts from a Searlean dilemma – we are bound to view consciousness as ultimately explicable by scientific means, yet science appears to give us no means for explaining the specificity of consciousness – and presents what I see as a plausible though speculative story for avoiding the brunt of the dilemma. The basic idea is (a) that consciousness, or anticipations of it, should be seen as pervasive throughout the biosphere; (b) that the biosphere, following Gerald Edelman, can be seen as the sphere of meta-systems irreducible to purely physical particles and forces; and (c) that it is plausible to view “full waking consciousness” as occurring at a very high level of meta-systematicity; with the conclusion (d) that full waking consciousness is both an expectable outcome of the biogenic forces and, in virtue of how it combines them, a very singular case.

Keywords: sentience; awareness; consciousness; recognition systems; Gerald Edelman.

1

John Searle’s basic stand regarding consciousness¹ can be characterized fairly briefly: we must take science seriously, and we also must take consciousness seriously. Taking science seriously implies the conviction that consciousness must, at least in principle, ultimately lie within the ambit of scientific research. Taking consciousness seriously implies the conviction that at the current moment we are very far from actually possessing a scientific explanation of consciousness, or even merely a detailed outline of it.

¹ Cf. especially Searle (1992) and Searle (1997).

This essay is intended as a very small contribution to the effort to resolve the dilemma. I will not comment on Searle's own arguments nor quote from his texts. Instead, I will formulate a position which I take to be *bona fide* in the Searlean spirit. I take the considerable liberty of exploiting the format of this volume to the full and leaving it to John Searle himself to state to what degree these suggestions might actually be acceptable to him.

2

A few preliminary observations: First, if the brain is taken to be the most advanced product of nature's biological engineering, and if consciousness is taken as a property of the brain, then it needs to be proclaimed very definitely that present-day science is nowhere close to explaining or replicating biological systems of comparable complexity. The clash between the advocates of scientism or eliminativism and those who oppose these reductive strategies does not really concern present-day research and technology. The main thrust of the polemics is about where our research and our technology could or could not take us, along a reasonably continuous route, a *very long* time hence.

Thus, second, it might seem peculiar that disagreement about something so distant should awaken so much interest and provoke such strong emotions. And here it will be helpful to point out a fact which all the concerned surely see yet are wary to declare openly: the polemics is, at the current stage, primarily – though not exclusively – a *cultural* one, which is to say, it regards a difference of *mindsets*. The reason why this tends to remain unsaid is, obviously, the need to keep the realm of serious, primarily academic discussion separate from the “culture wars”, i.e. the various excesses targeting science from a standpoint of fundamental rejection. Still, it needs to be admitted that the differences between the two culture clashes, while immense, are not total: there *are* certain continuities between the two discourses, and it is better that these overlaps, small as they might seem relative to the contrasts, be articulated exactly, in order to see their limits.

It is rather evident that the proponents of scientism and eliminativism view consciousness as the last vestige of old superstitions: consciousness is human, subjective and, globally, very scarce, and it is imperative (according to this camp) that it be swallowed by a broad and objective description, just as the Renaissance eliminated the uniqueness

of Europe, Copernicus eliminated the centrality of the Earth, Darwin eliminated the uniqueness of humankind, Einstein broke through the fundamental barriers of our sense-perception and Bohr finalized the destruction of the fundamental barriers of our conceptual thinking. To insist that the simple fact of consciousness has somehow escaped this triumphal march must seem, from the perspective sketched here, an obscurantist and regressive position.

I believe a fairly simple counter-measure needs to be taken. Copernicus, Darwin, Einstein and Bohr were builders of theories, and theories are impossible in a world without consciousness. The triumphal march of science *is, ipso facto*, a triumphal march of consciousness. The contrast is not between the microscopic and macroscopic infinities of the Universe and the scarce, discontinuous, weird and doubtful phenomenon of consciousness. Rather, the contrast is between the inhuman immensities of the Universe and the human theory-building capacity to comprise them – and this presumed contrast is actually quite close to a symmetry, even though it is not a simple symmetry. It may well be difficult to describe it in epistemological detail, but it is evident and indubitable, and it should be the keystone upon which the proponents of consciousness rest their case.

3

At another level, the advocates of consciousness ought to acknowledge a continuity between high-level consciousness and low-level sentience and proclaim the ubiquity of conscious and/or sentient phenomena throughout the biosphere. If, perhaps, we lack logically apodictic evidence for attributing (some form of) consciousness and/or sentience to horses, cows, lizards, birds, fish, plants and bacteria – and I am not sure that we lack such apodictic evidence, since I am not sure what it would be to possess it –, then it is a cognitive gap we should mark and register, but it gives us no reason for actually denying them either sentience or consciousness. While biotic phenomena may be scarce in the Universe they are not at all scarce on the Earth, and within the ambit of the sciences of life, consciousness and sentience – phenomena different but close – are simply all over the place.

I suspect a strong influence here is the assumption that the progress of science stands in a direct proportion to the gradual demise of anthropomorphism. However, in European intellectual history all critique of

anthropomorphism had a certain primary field, which was theology; and while it is true that, generally speaking, the progress of science went side-by-side with the theological tendency away from full-throated anthropomorphism and nearer the concept of a purely rational, mathematical God, this implies next to nothing about what we should expect once we simply leave religion aside. As a matter of fact, after Darwin we actually have a kind of obligation to be anthropomorphic with respect to the biosphere, since the concept of evolution obligates us to assume that whichever capacities we find in ourselves are to be expected – in some recognizably comparable form – along an indefinite network of evolutionary lineages. These initial expectations can certainly be disproved and frustrated by detailed research, but even so it remains legitimate, or even imperative, to adopt them as a preliminary starting point. There is no good basis for the notion that methodological skepticism with regard to consciousness and sentience in species other than humans should be the default scientific attitude.

4

Thus I take it that consciousness is a robust fact of nature: it is – either by itself, or in the anticipatory form of sentience – massively present in the biosphere, and it constitutes the cognitive form of all those vast stretches of the Universe that lack it materially. Even though present-day science might not possess a full-fledged account of it, it is plausible to expect that with the current state of our knowledge we should at least be able to articulate the principles which could reasonably lead to an explanation of the phenomenon.

In other words, consciousness by itself is not an urgent problem of current scientific research. What is urgent is the puzzle facing the scientifically minded whether and how consciousness can be, *in broad strokes*, incorporated in the picture of nature which we have attained.

I want to outline a defense of the claim that the principle of such broad incorporation – or a good candidate for it – is contained in Gerald Edelman's concept of *recognition*.² Edelman defines it as follows:

² For this concept in particular, I draw on Edelman (1992). The necessary background is, of course, constituted by Edelman (1987), Edelman (1988), and especially Edelman (1989).

By “recognition”, I mean the continual adaptive matching or fitting of elements in one physical domain to novelty occurring in elements of another, more or less independent physical domain, a matching that occurs without prior instruction. (Edelman 1992, 74)

A prominent example of a recognition system is the immune system: cells that carry antibodies multiply in proportion to the use found by the particular antibody molecules they carry. Edelman explains:

It exists in one physical domain (an individual’s body) and responds to novelty arising independently in another domain (a foreign molecule among the millions upon millions of possible chemically different molecules) by a specific binding event and an adaptive cellular response. It does this *without* requiring that information about the shape that needs to be recognized be transferred to the recognizing system *at the time when it makes the recognizer molecules or antibodies*. Instead, the recognizing system *first* generates a diverse population of antibody molecules and then selects *ex post facto* those that fit or match. It does this continually and, for the most part, adaptively. (Edelman 1992, 78)

Besides immunity, the other major types of recognition include heredity, neural reflexivity and the brain capacity of categorizing and re-categorizing (see Edelman 1992, 205).

Edelman stresses that in all this there is “no final cause, no teleology, no purpose guiding the overall process” (Edelman 1992, 74) – which is correct to a very large degree. However, a certain dose of qualification is needed here. While Edelman properly avoids positing any *particular* goals, he does elevate recognition (in the sense defined above) to a grand principle of nature, parallel with the principle of (physical) symmetry. By this he means that the establishing of recognition meta-systems (as, by definition, they have to include at least two relatively independent sub-systems) is a process irreducible in its entirety to physical particles and forces. For instance, it is a major goal of Edelman’s *Topobiology* (Edelman 1988) to point out that even though the development of the embryo certainly *obeys* the laws of physics, it is not reducible to them: embryogeny requires topological attraction and differentiation which is specific to the interactions within the cell population that eventually produces the embryo, even though the cells are not “instructed” toward a particular outcome, i.e. they do not “contain an information”.

All this equals saying that there is another force of nature besides the forces we would normally call “physical”, a force which we can observe in biotic processes. As I see it, the most cautious way of formulating this is to say that *there is a tendency in nature which, from a certain threshold, becomes observable as a biogenic tendency*, with “biogenic tendency” standing for a tendency to produce meta-systems of recognition in Edelman’s sense.

What do we gain by postulating such a principle? We gain the possibility to state that there really are organisms,³ and that there really is consciousness, while retaining the lessons of Darwinism and while attaining a very large degree of continuity between the purely physical and the biotic.

Does, then, modern science give us a clue to understanding consciousness? It does and it doesn’t. The *phenomena* described by biological chemistry, embryology and neurobiology contain the principle needed for achieving a rough integration of consciousness within the present-day, science-informed worldview. However, it is one of Edelman’s points that the pertinent sciences attempt to limit themselves to a purely physical description, thus leaving an explanatory gap. Edelman seeks to fill the gap. The result is a more complete description, one which works with natural recognition as a factor. The so-called principle of recognition, or the biogenic tendency, is, then, not formulated in the abstract, and perhaps that is just as it ought to be. It is sufficient that it can be *read off* the analogy between immunity, heredity, neural categorization and other, similar phenomena.

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However, immunity, heredity and neural categorization are non-conscious. How are we to get from recognition systems to consciousness?

One part of the answer I want to propose is: in the workings of the brain, the biogenic tendency establishes itself in multiple layers,

³ To be sure, I am not proposing any concept of organism in this essay, nor is it contained in Edelman’s books. But I take it that it is sufficiently plausible to assume that with due effort expended, the principle of recognition would allow us to provide a characterization of organism, or something substantively analogical to the traditional notion of organism, as a natural, inherently consistent entity.

or loops, to a degree unobservable anywhere else in nature; and this makes it plausible to state that consciousness is something very special *and at the same time* the outcome of a general natural principle.

I will list five *prima facie* plausible mechanisms of such layering. The first three can be called mechanisms of established or retained complexity. It is orientation, perception of an object, and proprioception.

Orientation means that a material stimulus appears against a system of dimensions (or a single dimension) in practical space: one and the same X can be near or far, within grasp or out of grasp, at the protected side or at the weak side; and depending on the attractive or repulsive character of the X, the organism acts and moves so as to keep it closer to one or the other extreme of the dimension. This means that orientation requires a coordination of at least two relatively independent systems, i.e. the system of material inputs and the system of orientation.

Perception of an object means that stimuli are inserted into a thing-system, with the present stimuli complemented by expected or excluded stimuli. We can leave moot the question whether these stimuli could be all of the same type, and simply state that typically, in higher organisms, they will be of various types: for instance, the same thing can be seen and smelled.

Proprioception denotes, in brief, the capacity of the organism to sense itself; or more cautiously, the capacity of the organism to have a wealth of stimuli regarding the tissues and organs that make it up.

It appears almost evident that the last capacity builds on the previous two: differentiated proprioception requires orientation, unified proprioception requires that the organism's body (or more precisely: the proprioceptive part of it) be perceived as an object – and proprioception is nothing unless it is both differentiated and unified. So it might be seen as a kind of *product* of the previous two capacities. But we have also reasons to think that the relation is reciprocal: (a) the development of proprioception opens new avenues for the development of orientation (therefore, it does not seem an accident that all the animals that manifestly share our experiential space also possess highly differentiated and subtly proprioceptive bodies); (b) one's body is the object the organism will come to know best, and in the most detailed manner, so that the organism's "subject" actually is and remains, in terms of long-term salience, the first object.

Thus, there is strong commonsensical evidence that practical space, objects, the several senses, and the body zone (as we can call it if we

want to avoid a too early mention of “self”) are systems of input which coordinate and develop via mutual stimulation yet also remain independent. In Edelmanian terms, this means that there must be multiple coordinated systems of recognition: the neural re-entry loops must cross without blending.

The other two mechanisms on my list can be termed simplifying mechanisms. I will call them awareness and consciousness, diverging from both Edelman’s and Searle’s use.

Let me characterize awareness as the capacity to pass from one regime of sensitivity to another regime of sensitivity. By regime I mean that the organism, in its channels of sensitivity, shifts emphasis *not* from one sensation or perception to another but rather from one range of sensations or perceptions to another, or differently tuned, range.

And let me characterize consciousness as the memory of awareness. The crucial point is that awareness and consciousness are capacities that concern capacities: awareness is the capacity to “switch on” or “turn up” this or that sense-channel; and consciousness is the capacity to remember awareness, i.e. a capacity.

Awareness, as I define it, is probably fairly close to Edelman’s primary consciousness, and it would be included in Searle’s use of the term “consciousness” without attribute. However, the point of my definition – if one accepts that it corresponds to something real in our human experience, as well as in the experience of higher mammals and perhaps other animals – is to bring out that it is an economizing mechanism: an organism has only a very limited range of senses; and awareness provides active access – a *unified* access – to their variety. Awareness can broaden its range or its subtlety, but in an important sense there is *just one*.

Consciousness, as the memory of awareness, then makes awareness thematic: every particular momentary modality of awareness appears against the background of awareness *tout court* – of all the other regimes that the organism might employ.

If we add up the simplifying mechanisms to the mechanisms of established or retained complexity, and understand them all as workings of neuronal re-entry, we get the idea of multiply crisscrossing yet distinct loops *topped over* with a re-entry mechanism related to entire large groups of re-entry mechanisms, a kind of directing center (i.e. awareness), *plus* yet another re-entry mechanism establishing a memorial loop for this directing center (i.e. consciousness).

To sum it all up and draw the conclusion: if we acknowledge the principle of recognition, or the biogenic tendency, as a real force of nature, then we have strong *prima facie* evidence to think that in highly developed brains, this force is combined, re-combined, and meta-combined to a degree not observable anywhere else in nature. As a result, consciousness appears *both* as a very special case *and* as a “logical”, i.e. non-surprising consequence of a broadly valid principle of nature.

6

Let me answer three objections that are certain to come up: first, the argument is circular – I explain consciousness by assuming it and working towards it; second, I do not explain why consciousness “feels” the way it feels; and third, the whole argument is too speculative to be of any scientific value.

For the first objection, that the argument is circular: That would be true if I was trying to demonstrate that consciousness exists. However, the existence of consciousness I hold for evident, and don’t try to prove it: consciousness is a given. What I am attempting to show is the explanatory compatibility of the phenomenon of consciousness with a certain rational view of nature. *This* I did not assume; it is a pure outcome.

For the second objection, that I do not explain why consciousness “feels” the way it feels: Consciousness is an evolutionary product of nature, and we simply do not have the option to second-guess nature and ask whether she could have proceeded otherwise: whether lions could have been made more gentle, eagles less hungry, and human minds somehow different in their feel. What we do try to explain is the evolutionary purposefulness – or precisely, the fact of their having been selected for – of the way things are. This is easy on the outward side of my argument: perceiving more, and having more control over one’s capacities of perception, is – *ceteris paribus* – a clear evolutionary advantage. Where it is difficult is on the inside: how come that the brain can evolve in this way. And here I simply draw on Edelman’s neural Darwinism, and on the principle of recognition it employs as a factor: if the functionality of even the simplest neural system is based on the capacity of re-entry, then it is not surprising that the further evolution of brains as neural centers should involve not only a more extensive

use of this capacity but also a structurally more complex use of this capacity.

For the third objection, that the argument is too speculative, moving in a realm too far away from any scientific theory of consciousness: This I will answer in two parts. First, it is not speculative, it is merely sketchy; and it is okay to rest content with a sketch if a sketch is all we need; and since my only goal was to point out – with more emphasis than I have found it said in Edelman – the multi-layered and multi-looped character of any complex experience *and* of the brain corresponding to it, I can rest content with a mere outline, confident that even if it stood to be corrected it is unlikely to become measurably simpler. Second, any scientific theory of consciousness *has* to start from some commonsensical divisions and descriptions, and it will never completely overcome this starting point. It is true that, from this viewpoint, I present here a list of starting points and “no beef”; but that does not make the starting points somehow illegitimate – and given that I have no competence in neurology whatsoever, it is only so well that I do not attempt to speculate about the possibilities of empirical research.

These are quick answers, not meant to convince the skeptic but rather to clarify some *prima facie* puzzles to a reader thinking along substantially the same lines.

7

So far I have stressed merely the overall correlation between the complexity of consciousness (or of its structural assumptions) and the complexity of the brain. Now it is time to get to the specifics.

I find my proposal attractive because I think it can give a plausible overall picture for an explanation of some essential features of sentience and consciousness.

Let me list some of the ideas the model suggests:

(a) If we accept that the motor of the evolution of sensation and perception is the interaction between orientation, the perception of an object, and proprioception, it suggests an idea why certain stimuli “rise up to full awareness” and others don’t. Why are we aware of our sensations but not of the detailed workings of our immunity system, or more plausibly, our visual or tactile system? My answer: because one has become involved in the interaction mentioned above, and the other hasn’t; one should resist the temptation to look for further rea-

sons. There is a certain minimum of looping complexity, quantitative and qualitative, which has to be attained in order for awareness to find purchase; and it seems to be at, or near, the crossing point of the three "lower" mechanisms listed above.

(b) The three "lower" capacities have certain structural constants: proprioception keeps a focus on the body occupied by the organism (as I put it awkwardly to avoid any mental expression), orientation relies on certain pervasive dimensions, and the perception of an object is anchored in the (evolving and flexible yet always characteristic) form of an object. Awareness, as I have defined it, is also substantially an awareness of their permanent cooperation. Thus, it is plausible to expect that an organism's awareness will have a structural constant resulting from this cooperation: an operative center of the principal dimensions of practical space, constituted by an object delineated by the proprioceptive area. Once available to awareness, this will already deserve to be called a self – emphatically, a self available to certain animals, too.

(c) Consciousness, as I have defined it, is a step above awareness: it is the memory of awareness. Awareness is, so to say, one in itself but turned to many; consciousness is one in itself and turned to one. Awareness is readiness to modify one's attitude to the situation, consciousness is the aggregated memory that every attitude to every situation is simply a case that can be modified. Thus, it is homogeneous, continuous, unitary.

(d) What is a plausible story about the evolution of consciousness out of awareness? I think there are two basic options: either a great ape wakes up one morning and finds itself self-reflective; or else an awareness of self (in the sense given above) passes over into an awareness of other. I plead for B. As a matter of fact, it only says that awareness is prone to spill over from the area of proprioception to the area of perception of an object (or, possibly, vice versa – which comes to the same for our present purposes), and that it colors the dimensions of orientation. Thus, objects given in experience can start to "behave" thus or thus, and therefore to have selves. If interaction of self with selves becomes non-sporadic, consciousness arises.

(e) If we accept the previous two points then it follows that the awareness of awareness is consciousness but the consciousness of consciousness is still consciousness. Of course this is partially just a matter of definition but my point is that it makes sense to draw the line this

way. Edelman believes that higher-order consciousness is created by language. My question would be, how can an animal possibly acquire the symbolic capacity if such a capacity as of yet completely transcends its horizons? Thus, I believe a more productive – and *more naturalistic* – formula is to set language in between consciousness and consciousness of consciousness. The speaking animal has all it needs to employ language, i.e. symbols, it only needs to find a suitable reservoir of them and to start using them; however, the encounters with (various employs of) language, once it is acquired and its use expanded, make the animal gradually conscious of what it had to have *in order* to acquire and effectively employ language. This starts a new round of interaction among the animal's capacities, one which is presided over by the imperturbable form of consciousness but which actually consists in new and even more productive combinations of orientation, objective perception, proprioception, awareness-as-readiness, and objectified selves.

8

In conclusion: I have started by characterizing the debates surrounding consciousness as, in important respects, debates *about* science rather than *within* science, and then debates about *general principles* rather than substantial particulars. In line with this, I have found it appropriate to present merely a likely story. The gist of it is that the human brain is the most complex yet somehow unitary arrangement of living tissue, and that this is what enables it to anchor the phenomenon of consciousness. I have used Gerald Edelman's neurobiological concept as a basis which has enabled me to spell out the manner of this complexity-in-unity. There may be other, very different neurobiological approaches that could fulfill the same role. The key point is that in order to do that, they have to understand themselves as sciences of life, not *exclusively* as sciences of electromagnetic resonances. Again, I have proposed the "biogenic tendency" as a force of nature whose prominence delimits the realm of life from the realm of non-life, and again I relied upon Edelman's interpretation of immunity, heredity and other processes of "recognition". It is up to specialists to decide whether Edelman's statements here might stand corrected, and in such a case, what I had to say about the "principle of recognition" would stand corrected too. But the crucial point is: corrected, not eliminated. It is on this basis that I feel

reasonably confident that the story, though merely likely, should contain an element of truth.

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References

- EDELMAN, G. (1987): *Neural Darwinism*. New York: Basic Books.
EDELMAN, G. (1988): *Topobiology*. New York: Basic Books.
EDELMAN, G. (1989): *The Remembered Present*. New York: Basic Books.
EDELMAN, G. (1992): *Bright Air, Brilliant Fire*. New York: Basic Books.
SEARLE, J. (1992): *The Rediscovery of the Mind*. Cambridge, (Mass.): MIT Press.
SEARLE, J. (1997): *The Mystery of Consciousness*. New York: New York Review of Books.