Gradualism and the Evolution of Experience

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Pre-print, near-final version, 2021. For *Philosophical Topics.*

1. Introduction

Sensing, nervous systems, and behavior evolved slowly, on a branching, roughly tree-shaped, genealogical structure.[1] Though evolution probably proceeds at various different rates, large-scale changes that involve the origin of complex new traits occur gradually, in a broad sense of that term; they do not jump into existence as wholes. If materialism is true, it seems that subjective or felt experience must also have arisen gradually. When that idea is introduced, metaphors and analogies come to mind: waking from sleep, light dawning, colors emerging. A gradualist view of experience itself encounters problems, though. If experience came into being gradually, there must have been stages when it was partly present, partly absent.

Some have said this is not possible in principle; subjective experience or "phenomenal consciousness" is simply present or not. Does that suggest a scenario in which smooth change at the biological level is accompanied by a sudden switching on the experiential side? That combination seems dualistic. Dualism would be avoided if the biology itself included a physical change akin to a phase transition. This is possible in

[1] I am grateful to Andrew Barron and Henry Shevlin for very helpful comments on an earlier draft, and to Harris Kaplan, Peter Carruthers, Gáspár Jékely, and Fred Keijzer.

principle, but we might instead try to make sense of a gradualist history, and hence the graded presence of subjective experience.

When this idea is introduced, another reaction one might have is surprise at what seems the radical liberality of the view. If the basis for experience is a collection of slowly-evolving abilities that enable animals to sense events around them and adaptively respond, then we have to grapple with the fact that this toolkit has forms in animals with very simple nervous systems, in non-neural multicellular organisms (sponges, plants, fungi), and in unicellular life. Do those creatures, too, have tiny scraps of consciousness? The view seems to lead to a kind of radical inclusiveness.

A gradualist approach need not lead there, for two reasons. First, not all gradualist views need see experience as evolutionarily old. Experience might arise gradually but still be a comparative latecomer, as the features underlying it are sophisticated cognitive peculiarities (such as working memory or a "global workspace" in the brain), or neural features tied to the cerebral cortex. These features might evolve slowly enough to fit neo-Darwinian ideas about the gradual evolution of complex adaptive features, while not being at all common in animals – restricted perhaps to vertebrates, to mammals, or more narrowly still. A gradualist view can be historically shallow or historically deep.

Second, even if a gradualist story is historically deep, that does not, or need not, imply a liberal view of the distribution of experience. Simple liberality is part of what a gradualist view wants to get us beyond; the aim is to leave behind simple "in or out?" questions. To note that height is a graded property is not to argue that a lot of extra people are tall. Similarly, a gradualist view here is not an attempt to put plants or bacteria *in* to the category of sentient or conscious organisms, but to change how we think about that category.

The height analogy is misleading in one respect, as height exists on a single numerically describable scale. To say that subjective experience exists in a graded way and evolved gradually need not include a commitment to a single scale from more to less conscious or sentient. Many varieties can be recognized, where these are related to each other by small changes on various dimensions.

These questions about gradations have both a synchronic and a diachronic side. The synchronic side concerns the distribution of varieties of subjectivity in organisms

around us in the present. The diachronic side concerns the evolutionary history itself. Ancestral forms need not be very similar to anything around us now, though variation in what is around now often provides clues about the historical questions.

The aim of this paper is to explore all those themes. A central goal is "making space" for gradualism about the origin of experience, and for a graded view of the associated synchronic questions. I'll also give a provisional defense of a particular gradualist position. It's not possible to go far on these matters in isolation from a view about what subjective experience is, so early parts of the paper will sketch a position assumed at least for purposes of this exploration. Then I'll look at the historical side, focusing on some especially pivotal stages.

This paper is about the category often now described as *phenomenal consciousness,* or phenomenally conscious experience. The word "consciousness" remains problematic here, as it suggests a sophistication that is misleading, even when that connotation is officially disavowed and phenomenal consciousness is unpacked in terms of Nagel's "something it's like..." criterion (1974). "Subjective experience" is a better term, and "felt experience" perhaps better still, though "consciousness" has advantages of linguistic flexibility, with adjectives and adverbs ready at hand. We can expect language in this area to evolve, and I don't want to lay down the law. I'll use "experience" and "felt experience" most of the time, except when discussing the views of others. I'll also sometimes use "sentience" in preference to "consciousness." "Sentient" tends to have connotations related to valence – pleasure and pain – and they are set aside here; a sentient organism is one that can have subjective or felt experience of some kind.

2. Experiential Profiles

It's not possible, I said, to make much progress on these topics without staking out, at least provisionally, a view of what felt experience might be – not necessarily in relation to a physical basis, but at least in relation to other aspects of the mind, especially its "cognitive" side. Two recent traditions in this area can be roughly distinguished. A view popular in much of the latter part of the previous century had it that subjective experience is just cognition as seen "from the inside." Experience is a matter of what it feels like to *be* a system with some core functional properties enabling perception, memory, and so

on. If so, experience of some form will be an inevitable consequence of the evolution of sensing and the control of behavior, and this fits naturally with gradualism about its evolution. As biological systems of the right kind come to exist, there comes to be something it's like to *be* such a system. With the gradual evolution of sensing, acting, learning, and so on, there comes a gradual coming-into-being of experience itself. Qualia (in the literal sense of felt *qualities*) are felt aspects of this first-person perspective on the operation of a cognitive toolkit that exists in simpler and more complicated forms.

That picture has largely given way to another, in a process that began perhaps near the turn of the century. According to many more recent views, subjective experience cannot be just an insider's perspective on a basic cognitive toolkit, because experiments show that a lot of sensing and processing of what we sense can occur *un*consciously (in a broad sense of that term, where to be unconscious is to be entirely unfelt). Much of the basic business of sensing and cognition can occur with no felt side at all (Milner and Goodale 2005, Dehaene 2014, Prinz 2014, Carruthers 2019). These views are empirically informed, and appeal especially to experiments and lesion studies that probe the boundary between conscious and unconscious sensing, usually vision. The focus of work then becomes a contrast between conscious and unconscious processing *within* what is taken to be a broader category of cognitive activity.[2] The new goal is to find some special features – a style of processing, a routing – that make some activity conscious. This routing might involve working memory or an attentional spotlight; these are features that go beyond what might be seen as a basic toolkit for a behaving animal. Experience, on this view, is not an inevitable consequence of sensing and behavioral competence, but something more restricted. If consciousness depends on characteristics like these, it could

[2] Terminology also shifted in a relevant way. The problems of "consciousness" and "qualia" were fairly often seen as separate in the later twentieth century. The question of how materialist views might explain qualia was in some ways the more fundamental problem, and consciousness was understood as a sophisticated aspect of mentality that has both a qualitative and a cognitive side. More recently, consciousness and qualia have been treated as one problem rather than two, partly because of acceptance of the broader sense of the word "conscious," where it refers to felt experience or phenomenality in general. I don't suggest these terminologies were used uniformly at the different stages (see the discussion of Armstrong below, for example).

still evolve gradually. But the process will be one that began later, and probably in just a few branches of the phylogenetic tree.

The idea of unconscious processing was not denied altogether in the earlier tradition. But it did not pose the same problem, perhaps because a distinction seemed available between the *core business* of sensing, learning, and acting, on one side, and various kinds of secondary processing that don't have the same status. An example is handling the grammar of sentences. This, it seems, could be buried somewhere outside of experience. It's different to say, as people have for a few decades now, that what seem to be core features of real-time sensory and cognitive processing can proceed unconsciously.

For Carruthers, for example, the experimental demonstration of unconscious human perception is a data point that constrains all theories in this area (2019). "Dorsal stream" vision is an exemplar of this kind of perception, and one that points to a general distinction between conscious and unconscious processing paths. Within this way of looking at things, a number of apparent "bridges" in this area are not really bridges. This includes the idea of *point of view* (Nagel 1986). One kind of point of view, Carruthers says, merely involves partiality (in sense of incompleteness, not in the sense of evaluation). Point of view is present in unconscious perception as well as conscious; it is not something with an inherent link to consciousness.

The disagreement between these approaches is multifaceted, and I don't try to entirely resolve it here.[3] The earlier tradition, as I described it, does seem to encounter problems from the simplicity of the idea that experience is explained in terms of what it is to *be* a system that fits a basic cognitive profile. For this view, any kind of unexperienced mentality becomes a problem. The more recent approach has, in a way, the opposite feature, in its claim of a very narrow pathway to consciousness. In some versions of this more recent approach, for example, it is claimed that only one thing can be in consciousness at a time – one percept or feeling, or the present deliverances of one sensory modality (Dehaene 2014). That one-item view is not essential to the newer tradition, but the general approach is one that sees much restriction and selectivity.

[3] For especially relevant discussions, see the recent work of Overgaard (2018), Phillips (2020), and Fazekas and Nemeth (2021).

The earlier tradition also had what may seem a large-scale philosophical advantage. Does it seem likely that the later-evolving bells and whistles that more recent views posit can really bring experience into existence from its absence? Does it seem likely that without these special features, life feels like nothing at all? If a person is very deflationary about the idea of consciousness, this is not a problem.[4] And the philosophical argument does not seem very strong even setting aside deflationism; it is based on the idea that we can see a kind of commensurateness in the relation between explananda and explanans in this area, and use that to constrain options. Judgments of that kind seem unlikely to be reliable. However, this point is related to another problem encountered by the more recent tradition, which is how these views handle animals very different from ourselves – animals lacking a cortex, lacking most or all of the vertebrate architecture that the newer views make use of in their explanations, but with behavioral indicators of states like stress and pain. This is what Shevlin (2021) calls the "specificity problem" for the recent crop of theories. Might the basis for *some* sort of experience be less tied to the way we vertebrates happen to do things?

In response to all this, I'll sketch a view that is intended to be responsive to both traditions, though in some ways more sympathetic to the earlier one. The view will be sketched in a way that is supposed to have some intrinsic appeal – it is supposed to point towards the resolution of some puzzles – but I won't defend it in detail in this paper.

I will introduce this view with a case often used in philosophical debates about how much we are conscious of, or how broad experience is. This is the case of the inattentive long-distance driver, due originally to Armstrong (1981a, b). Here is how the case is now often presented. A driver on a monotonous or routine trip is competent on the road, in basic navigation, perhaps even in avoiding minor problems, while daydreaming or attending to other things – perhaps plans or memories. Then the driver "comes to" and notes that he or she has driven a long way without realizing it. This everyday case is often taken to support the idea that a lot of basic processing sufficient for competent behavior can be unconscious. In versions of the recent tradition that claim that only one thing can

[4] For Carruthers (2019), for example, the apparent specialness of conscious experience involves no more than having representations with content of a special kind that can figure in zombie thought experiments. If so, it is not surprising that late-arising features bring experience, in this sense, into being.

be in consciousness at a time, the idea would be that the driver's experience at each moment is occupied by the road *or* the radio *or* a daydream, and the road is outside of experience entirely, until it is suddenly attended to.[5]

Armstrong's own versions of the story were presented differently. There, the driver is not said to be inattentive to the road because something *else* is occupying consciousness, but because he or she is, in one sense, not conscious at all, before the moment of "coming to." Does that mean that for Armstrong you can be awake and active but have no felt experiences of any kind? You can drive all that way while there's nothing it's like to be you? That is not what Armstrong meant. As he had it, there was a kind of consciousness present – actually two kinds – although another kind was absent. What was present included "minimal" and "perceptual" consciousness, and what was absent was "introspective" consciousness. This, as he saw it, was wholly absent, not just limited with respect to its content. In more recent discussions, the story tends to suppose that there is *something* going on consciously in the driver the whole time – it would not be possible to drive all that way while being entirely, literally unconscious – while other things that might have been in consciousness, such as the road in the initial part of the story, are entirely out.

Here, in contrast, is what seems to me a natural way of describing cases like this – describing them first as they appear, setting aside neurobiological questions. A driver has at each moment an *experiential profile.* That experiential profile typically includes something in attentional focus, and a lot more that contributes to experience while being, to various degrees, in the background. This can include various sensory elements that are not attended to (the road, the car seat, the temperature), and also a mood, an energy level, and so on. These all contribute to the driver's experiential profile. Even if the driver is attending entirely to tomorrow's plans, if they were not driving along and dealing with the road – and doing so a certain number of hours from their last meal and on a seat with that shape and hardness – it would *feel different to be* them at that moment.

People contributing to these debates quite often do want to deny this last point. I sometimes wonder whether those people's experience is quite different from mine –

[5] For discussions of the driver, see Lycan and Ryder 2003, Tye 2016, Carruthers 2019, Stoljar in press.

perhaps some people's attentional focus is particularly strong.[6] But I think that some people may think that experimental data and other scientific work show that a very narrow character to experience is how things *must* be, and against that background, they can nudge their phenomenology more or less into line. If so, I would like to loosen things up.

If a person does want to hold fast to a one-at-a-time view of experience, or something similarly narrow, then how are features like mood and energy level to be handled? There might be a very rapid switching between items, so each of them occasionally, in turn, becomes *the* thing experienced. Alternatively (or as well), these features might be said to make a difference *to* experience when unattended, while making this difference "from the outside." That might make sense in the case of energy level, for example; energy level might affect how things feel without itself being felt.

A third option is the view that a single item in consciousness might be a sort of squashed-together or abstracted "gist" of various things is going on.[7] Gist consciousness applied to a single modality (the gist of a complex visual scene) makes sense. I am not sure if this is distinct from a "broad profile" view when we include multiple modalities, energy level, and so on. Suppose, for example, that you are driving with some real attention to the road but a song is "stuck in your head" as you go, an accompaniment and something that provides a rhythm to both your experience of the road and some of your actions. This seems to fit poorly with all the alternatives to the broad profile view. I suppose it's hard, again, to rule out the possibility of very fast attentional switching: song-road-song-road. And a view that insists on a narrow pathway to consciousness might

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[6] Here is an intriguing comment that might lead somewhere important, from the brain lateralization expert Lesley Rogers: "A body of research has shown... that the majority of humans use the left hemisphere when they perform established or routine patterns of behaviour and, when using this hemisphere, their attention is focused. By contrast, the right hemisphere of humans has a broad attention used in detecting and responding to unexpected stimuli and responding to affective stimuli..." (2017, p. 2).

I think that discussions of "driver" cases, and the like, show some degree of terminological disorder, where people more or less agree on what is going on but struggle to describe it, along with what might be some genuine and marked phenomenological differences between people. See also O'Brien and Opie (1998) for an insightful discussion.

[7] For "gist" idea see Cohen, Dennett, and Kanwisher (2006), and (more critically) Haun, Tononi, Koch and Tsuchia (2017).

accept a pathway with at least a couple of different things, such as road and song. But one might instead think that cases like this open the way to a broader treatment.

The view I support is that a typical human experiential profile is multifaceted; it includes perceptual aspects, affective aspects, energetic aspects, and perhaps others. A single element can be the focus of a huge amount of attention, but background elements such as mood – background *facets*, better expressed – make a difference not only "from the outside" but can be contributors to experience itself. The way to make sense of how these things can be contributors to experience might be not to see them as jostling for a place in a narrow spotlight, with one or two other elements alongside, but as part of a profile that is more basic, as far as experience goes, than what the spotlight is doing.

There will then be two kinds of questions about the experience of an ordinary human at some particular moment: (1) What contributes to their experiential profile and what is the physical basis for this profile? (2) What is foregrounded at that moment, and what is the basis for that? Alternatively, there might be a three-way distinction with nested sets: the experiential profile, what is reportable in principle, and what is in attentional focus. Within this view, questions about the character of a present experiential profile become entirely separate, in principle, from questions about even the most momentary recall and reportability. Some features of what is being felt at a moment might be gone, unremembered and unreportable, almost immediately.

This view of experience, especially that last part, connects to Block's work on "overflow" – the idea that momentary experience can overflow what can be processed downstream, even by cognitive mechanisms such as working memory that have especially close connections to experience (Block 2007, Overgaard 2018). The view developed here includes overflow in Block's sense. The basic idea of overflow does not imply the view that whole experiential profiles are the right units here, or the "internal" way I handled features like mood and energy level; those are additional.

The idea that more than one thing (many, in fact) can be part of experience at once is not supposed to be a philosophical "intuition," but something more like an observation report. It is intended to be a description of an observable feature of experience. The report is not supposed to be infallible. One possibility that makes for fallibility is the rapid switching between topics that was mentioned above. It seems to me

that some quiet music and the letters on this screen are both experienced at once, but I can't really be sure I am not switching. I accept that if switching of this kind was happening, I could not tell from the inside, in an informal, non-experimental way. Despite this fallibility, the claim I am making is supposed to be more of an observation report than a philosophical intuition of the "Here is what surely makes sense..." kind.

I imagine that some of what I have said might seem contentious while other parts might be seen as perhaps wrong, but not surprising. The idea that more than one thing can be experienced at once (road and hunger, for example) is not surprising to many people, though this does not seem to be true of everyone. (As I said earlier, it may be that some people's attentional focus is more overwhelming than it is for others.) This is an idea that people often have to be pushed away from with empirical arguments. The idea that the basic "unit" of experience is a broad profile, characterized in terms of a collection of features or difference-makers, is more unorthodox. This is close to controversial ideas sketched by Tye (the "one experience" view, 2003) and Searle (the "unified field" picture, 2000).

The view of ordinary human experience I will work with below sees experience as simultaneously broad and attention-focused, with its breadth recognized through the idea of an experiential profile. I won't defend that view in more detail than I did above, but will instead adopt this view and move ahead with it.

3. An Evolutionary Path

The previous section sketched a view of experience in the normal adult human case. If this is how things are for us, how did we get here? How might a gradualist evolutionary story about this situation work? Are there clues to the past in what I've said about the present? The view sketched in the previous section does not imply a particular evolutionary picture, but it does suggest some possibilities and pathways.

I said that a typical experiential profile has a kind of "breadth plus focus." One way to develop this view is to say that the breadth side is more basic to experience than the other side. That breadth, the bringing-together of different elements or facets, is related to subjectivity itself – to having a point of view and being a locus of sensing and

action. The focused side comes later, with transformation of experience by additional traits specific to our line – yielding a "derived" form, in the evolutionary sense. (Certainly *some* of that side comes later, such as the link to report and reflective higher-order thought). Vertebrate-specific sophistications that are often treated as the basis for phenomenal consciousness itself, in recent views, would then be seen as experience-shaping or experience-transforming traits, arriving later in evolution than whatever it is that gives an animal an experiential profile at all. The derived experience-shaping traits in other animals can be very different.

This first option has a natural relation to approaches to the physical explanation of consciousness that use the idea of *integration* of some kind. That approach has been taken in a particular direction by the "Integrated Information Theory" (IIT) of Tononi and Koch, where integration of activity is *all* that matters to the status of a system as an experiencing being (Tononi and Koch 2015, Koch 2019). But their theory, where integration has no essential connection to sensing, action, and so on, is not the only way to develop the idea. It is also possible to link the integration of activity more closely to the business of being an animal – to acting and sensing – and to see the breadth of experiential profiles as reflecting this.

That is one path, but the present is also compatible with other histories. It's even possible to argue for a reversal of the priority hypothesized in the previous paragraph. One tradition in comparative psychology and neuroscience has it that integration is an optional feature even in very complex animals, and many of them are rather disunified, with distinct sensory streams, extensive lateralization, and so on. Perhaps, then, the "breadth" or copresence of various elements that I discussed in my description of human experiential profiles might be a later-arriving, derived trait. Other animals may have experiences – experiential profiles, in a sense – that are very different from ours with respect to the bringing-together of features discussed above. A view like this rejects the idea of integration as basic to experience in some way; the story has to take a different route.[8]

Without trying to resolve this opposition, I will follow one track here, one way of provisionally putting the ideas above into an evolutionary setting. In this account,

[8] For these phenomena involving disunity, see Godfrey-Smith (2020b).

experience in general has a basis in a fairly broad set of biological and cognitive capacities, and the bringing-together of elements as seen in our experiential profiles *is* intrinsic to experience in some ways. Within our line – in mammalian and then human evolution – these capacities are transformed with new features, giving human experience its focused qualities and temporal organization, along with its links to report and reasoning.

Before exploring the evolutionary side itself, I'll respond to the idea that gradualism about subjective experience or phenomenal consciousness has a special problem in principle. For some philosophers, subjective experience or phenomenal consciousness must be either present or absent determinately. It's not that gradations can't be part of the story, on these views – many parts of a complete story might be gradualist, in form – but there is a basic yes-or-no question as well. For example, Birch, Schnell and Clayton (2020) is a detailed discussion of degrees and gradations of consciousness in animals, recognizing several dimensions, but critics of gradualism could accept the ideas in this paper by saying that all the cases they discuss are *yes* cases, that just differ in richness in various ways. Those differences can be discussed as gradations or degrees of consciousness, but only against the background of a first categorization into presence versus absence.

Although the evolutionary implications are not usually highlighted in anti-gradualist discussions, the view defended does have the consequence that experience must come into being in a discrete step. Versions of this view are asserted, or defended to some extent, by Bayne, Hohwy, and Owen (2016), Simon (2017), Carruthers (2018, 2019), and others.[9] The following passage is from the Bayne, Hohwy, and Owen paper:

> [T]he notion of degrees of consciousness is of dubious coherence. According to the standard conception of consciousness, a creature is conscious if and only if it possesses a subjective point of view.... Arguably, the property of having a subjective point of view is not gradable – it cannot come in degrees.

9 "And others" – Michael Tye at an NYU conference on animal consciousness, 2018, also rejected gradualist possibilities in his talk, and discussion at that conference is part of what set this paper into motion. Tye (personal communication, 2020) says that he is presently refining his view in new work on the topic.

> In this way it resembles being a member of the United Nations rather than being healthy, which clearly can come in degrees.
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> ... someone in a state of normal alert wakefulness might be conscious of more than someone who is mildly sedated, but they are not thereby more conscious. (Bayne, Hohwy, and Owen 2016, p. 407).

The context of this passage is a discussion of anesthesia and brain damage, rather than evolution and other animals. And part of what Bayne and his coauthors wanted to emphasize is the absence of a single ordering from more conscious to less, a point I agree with. But the claims made about degrees are broader, and I disagree with those. A single ordering is not the only alternative to a dichotomous (member of the U.N., or not) situation. As Fazekas and Overgaard say in a commentary (2016) on the Bayne et al. paper, there might be many dimensions of consciousness, with gradations on each.

For comparison, consider biological complexity in general. Complexity is, roughly speaking, a graded matter, not a dichotomous one. But there is not a most complex organism, a second most complex, and so on. There are many dimensions of complexity (morphology, genetics, life cycle...). On those dimensions (or still finer ones), distinctions of degree are found.

Some claims about the in-principle impossibility of gradations seem to be based on intuitions about what experience could possibly be like. Here we have good reason to be skeptical of intuition. We are trying to get a handle on phenomena that are both unusual in themselves *and* special with respect to our viewpoint on them. Our mixed first-and-third person vantage point on the mental is, if materialism is true, an ongoing source of intuitive distortions (Nagel 1974, footnote 11). Other arguments, including some in Carruthers (2019), are based on demands associated with our "concept" of consciousness: Whatever might be present in nature, if something counts as consciousness *for us*, it cannot exist in degrees. But because of the difficulties cited just above, along with a historical record of conceptual change, there is no reason to feel wedded to the particular concepts we find ourselves with, even if those concepts have the

features Carruthers alleges. We are feeling our way forward, trying out concepts as we go, trying to shape them around what we encounter.[10]

Standard language in this area does suggest sharp dichotomies, often, though not always, through metaphors. The language of "lights on" is a metaphor. The "something its like..." formulation also suggests a dichotomy (something versus nothing). But although Nagel's wording is a good first gesture towards the problem, it does not constrain solutions.[11] This "something" is not really a *thing* that needs to be determinately called into existence; the Nagel formula is just a way of talking about the fact that some beings experience their lives, and this ability might well be a graded matter.[12] Quirks of language (or more than quirks) may be responsible for a range of apparent difficulties with a gradualist view of experience. But once the origin of these difficulties in ways that we talk is seen, the right response is to discount them and expect to find ourselves, when more is known, talking a bit differently, or talking differently in contexts where the details matter.

In this respect, the situation may be akin to the case of *life.* One can imagine, at an earlier stage in biological knowledge, an argument being presented that life is a definite thing in principle; life is either present or absent and cannot exist in degrees. In that case, as more came to be understood about life, including an understanding of borderline cases (especially viruses), we came to see that our categories require partial reorganization. Life is better understood when broken into a cluster of capacities – or perhaps two families of capacities, one involving metabolism and one involving reproduction. Viruses can be recognized as being in the vicinity of life, but lacking some of the cluster.

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[10] For a detailed discussion of Carruthers' arguments, see Birch's contribution to this volume.

[11] The reification of qualia, or of the sensations that have those qualities, may also lie behind some intuitions about the impossibility of gradations. The "act-object view" of sensory experience (Jackson 1976) requires for experience that a mental object of the right kind exists, so it can stand in the right relation to an experiencer. Together with a sharp distinction between existence and nonexistence, this suggests the impossibility of gradations. An "adverbial" view of qualia does not have this feature.

[12] Some other bridging concepts here are friendlier to gradualism. One of the things that puzzles me in the Bayne et al. 2016 quote above is the idea that the existence of a "subjective point of view" cannot be a graded matter. This I think is one of the more helpful bridging concepts from a gradualist perspective. A point of view can become more or less defined and definite, and perhaps a whole range of viewpoint-related cognitive properties are graded in nature.

We might say that viruses are not fully alive, but can also say that it's better not to talk as if life is a definite property. "Alive" can remain useful as a loose term, but its varieties and gradations are best handled using other language.

As the analogy with life reminds us, a gradualist account of experience, both in the diachronic and synchronic contexts, can take the form of an explanation of the history and distribution of a cluster of things other than *experience*. In us, the cluster comes together and we call the result "experience," but elements of the cluster might each have their own histories. That is not the only possibility; a more direct explanation might succeed, an account in which some physical or biological process just *is* experience, and this feature, empirically, comes in degrees. The Integrated Information Theory (IIT) of Tononi and Koch (2015) is a view of that kind. This view recognizes a single graded feature of systems, a feature present in the same form all the way down to its appearance in objects that are usually seen as entirely mindless, including some everyday artifacts. The IIT, according to Koch, holds that "a non-zero Φ^{MAX} implies a corresponding tiny amount of experience" (2019, p. 160) It doesn't imply an amount of something that is, in virtue of an underlying cluster of features, experience-*like*, but *experience*.

The view I will sketch is of the other kind. Roughly, it is a view that sees experience as arising in a natural way from some early stages in animal evolution.[13] But it does not work by finding a single magnitude or graded feature and identifying it with experience – the view is a bit more cluster-shaped.

The starting point is a recognition of something that initially seems awkward for gradualist views, a point mentioned in my Introduction: What is now often called "minimal cognition" is extremely widespread across living organisms. Minimal cognition is a package of capacities, including sensing and responding to conditions, perhaps also bringing present and past together in some form of memory, and integrating different sensory cues. The "responses" here are not mere effects, but reflect the importance of sensed conditions to the vital projects of the organism. Minimal cognition is not restricted to animals; it is a feature of all known cellular life.

[13] This scenario adds to and in some ways modifies earlier ones, most recently Godfrey-Smith 2020a.

One inference that might be drawn is that if minimal cognition is ubiquitous, then minimal sentience must be as well. There is an element of truth in this. *Part* of what makes up experience is brought along with minimal cognition, or perhaps some of its variants (this depends on what minimal cognition includes). Some subjectivity-related features have their basis here: sensing, seeming, and a thin sense of "point of view." It is surprising that these features are quite so widespread in nature, but that is what we've found.

In animals, these features were reinvented on the multicellular scale – reinvented with differences and elaborations. This was made possible by nervous systems. Much of the origin of nervous systems is unknown and some stages are quite controversial, but I'll provisionally assume that nervous systems first evolved in animals with a broadly cnidarian-like form, though not animals necessarily resembling any present-day cnidarian (the group that includes corals, jellyfish, and their relatives). I'll assume also that the early evolution of nervous systems in these animals was especially concerned with the organization of action – the coordinated movement of body parts on a multicellular scale.[14] The cnidarian body plan is radial, and in present-day cnidarians is seen in two forms: the polyp form, cautiously believed to have arisen earlier, and the medusa (jellyfish) form, thought to be a later addition.[15] Several groups feature a cycling between these two kinds of body.

The familiar description of present-day cnidarian nervous systems has been that they are "nerve nets." Finer-grained recent work in the polyp *Hydra* has revealed four distinct nets, with specialized roles. These circuits are each spread through the body, but without overlap. Dupre and Yuste (2017) suggest that this organization might be present generally (or approximated) in the polyp body. Work from longer ago had also shown a tendency for rhythmic activity in *Hydra* nervous systems (Passano 1963). Their neural networks are not mere input-output devices, but producers of oscillatory patterns, modulated by relatively simple senses.

The medusa form, seen in some cnidarians (but not in *Hydra*, and not in corals and anemones) is often an active swimmer. Neural activity in medusae has not yet been

[14] See Keijzer, van Duijn and Lyon 2013, Jékely, Godfrey-Smith and Keijzer 2015.
[15] See Jékely, Godfrey-Smith and Keijzer 2021.

analyzed at the level of detail seen in the *Hydra* study, but their sensing is more sophisticated and behavior more integrated (Jacobs et al. 2010).

A more dramatic transition for animals was the evolution of the bilaterally symmetrical (bilaterian) body. Bodies of this kind came to the fore in the Cambrian, where a new behavioral and evolutionary regime arose, featuring predator-prey interaction that placed a premium on motion and sensing, including vision. Along with a transformation of bodies, this transition saw a reorganization of nervous system activity within those bodies. This transition included more openness to complex exterosensing (including vision), and probably around this stage, new relationships between sensing and acting, especially in the handling of *reafference*, the effects of action on the actor's own senses.[16] Reafference can be both a problem – a source of ambiguity – and an opportunity, as action is revelatory of hidden environmental structure. Even very simple bilaterian animals, such as the nematode *C. elegans* with about 300 neurons, devote some circuitry to compensating for reafference, by registering ongoing action as it occurs and interpreting sensory input in this context. Neural circuitry directed on reafference compensation *per se* is not known in cnidarians at present, though it might one day be found, especially in medusae. Once this kind of neural organization is present, it amounts to a processing of what is sensed in a way organized round a tracking of *self* versus *other*.

Other recent work on both bilaterian invertebrates and vertebrates has shown the presence of global patterns of brain activity that are associated with ongoing behavior (Kaplan and Zimmer 2020). This is described by Kaplan and Zimmer as a situation featuring brain-wide "representations" of action patterns, though what representation amounts to in this case is not yet clear – whether, for example, these large-scale neural patterns *direct* actions, *register* what the animal is doing, or both.[17] Described non-representationally, the situation might be seen as one where these neural activities are within-skin components of larger patterns that both include and maintain particular behaviors. This action-associated activity is not present just in "motor" areas but also in "sensory" ones – the distinction may become problematic. These global patterns of

[16] See Crapse and Sommer 2008, Jékely, Godfrey-Smith and Keijzer 2021.
[17] See Webb 2006 for a relevant discussion of the postulation of "representation" in contexts like this.

activity can also be modulated by incoming stimuli of various kinds, and given the breadth of the pattern's realization within the nervous system, sensed events can modulate the activity at many points in the network. Patterns of this kind are seen in similar form in bilaterians whose most recent common ancestor is the protostome-deuterostome common ancestor, living before the Cambrian. So this feature is very old, if conserved. It is described by Kaplan and Zimmer as a candidate for a "universal principle" of neural activity, though the patterns they are describing have so far been seen just in bilaterians.

The picture taking shape is one in which ancestral nervous systems feature large-scale or global patterns of activity that are concerned with the shaping of action, and these patterns of activity take on new roles in the context of the Cambrian, with distal sensing, a handling of reafference, and the like. The nervous system has an ancient role shaping action, in a way modulated by transduced events, and these patterns of activity become a platform in which more is laid. There is a transition from a nerve net whose role is largely coordinative, making possible macroscopic action, to one that is, increasingly, the basis of a richer form of agency and subjectivity.

Expressing the sequence in rough stages, we have an initial situation with minimal cognition present even in unicellular organisms. Minimal cognition brings with it some subjectivity-related features. These acquire a new realization, at a different spatial scale along with much elaboration, in animals. Early stages of nervous system evolution include the origin of various large-scale dynamic patterns in neural activity. Such activity is initially task-specific and not integrated, as in *Hydra*, perhaps more integrated in medusa forms, and then further integrated in bilaterians. As emphasized by Kaplan and Zimmer, such large-scale action-related patterns can be perturbed in information-rich ways by both exogenous and internal events. In the Cambrian, activity of this kind is reorganized with a stronger role for specialized exterosenses, and is conditioned by extensive reafferent coupling between sensing and action. This yielded a kind of firming-up and elaboration of subjectivity: exterosensing, self-other, engagement with distal objects. An upshot of these developments was an increasing *experientialization* of neural activity.

Why does this yield "experientialization"? The outcome we've reached at this stage might be biologically distinctive, but why is it experience-like in a way that contrasts with other arrangements, or other ways things might be?

Speaking for myself, once this arrangement is in place, it is hard for me *not* to think of the result as something akin to an experiencing being. In my own case, the situation outlined above prompts an intuitive shift that amounts to a significant closing of the "explanatory gap," in Levine's sense, between physical and experiential (Levine 1983). But intuitions of this kind don't count for much on their own. What is it about this situation that makes it even a candidate for gap-closing? I'll discuss a number of angles on this question.

The scenario is one that combines a general picture of nervous system activity with its embedding in a functional context related to subjectivity. This situation features some particular kinds of integration, in both the formation of the animal as a locus of subjectivity – an integrated locus of sensing and action – and in the way this is achieved in nervous systems. Those nervous systems feature large-scale coordinated patterns of activity, modulated by sensing. As emphasized by Kaplan and Zimmer, action-related patterns in the brain can be modulated by both exogenous and internal events in concert. A similar point is made by Ginsburg and Jablonka (2019): when neural activity has the form of large-scale patterns with modulation, a range of different senses can have capacity to affect any state. An internal state strongly affected by what the animal is (say) seeing will, if the animal is mobile, also be affected by ongoing tactile sensing, proprioception, and the like.

The scenario is then one where large-scale patterns of activity provide a kind of natural platform for the integrated processing of sensory and other information. With this, the animal's real-time response to situations can be affected by a sort of *gestalt.* As well as playing a role in the control of behavior and learning, this set-up also has an apparent mapping to the "experiential profiles" discussed in the previous section. There I suggested that a kind of integration of scene and situation is a basic feature of subjective experience. We now find ourselves on a path to a biological basis for something like those profiles.

When this mapping is made to the experiential profiles of earlier parts of this paper, it might be reasonable to wonder if progress is coming *too* easily. A theme of much recent neuroscience has been the amount of work a brain has to do to get a coherent picture of the world to arise from information of different kinds. Different processing streams handle different features sensed, such as color and shape, and brains can mismatch, or fail to correctly "bind," colors to shapes when things don't go normally. There is a way of telling a story about experiential profiles and their relation to neural activity that makes it appear that all this should be achieved effortlessly – that the activity that brings experience into being will achieve this binding "for free." That does seem too easy. Some accounts of how sensory "binding" works do make extensive use of large-scale neural patterns that are apparent descendants of the oscillatory patterns discussed above (Singer 2018), but I don't want to assume a particular hypothesis in this area and won't try to resolve the issue. I will raise one possibility, though. Perhaps the experiential profiles in animals very different from us, with simpler nervous systems, might have a kind of "breadth" but where experience is less differentiated into perceived *features* than it is in us (where we find colors *and* shapes *and* a sense of what our body is up to..., all in there together but also discriminable). Experience in some other cases might be more of a multi-faceted wash, rather than being, as in our case, feature-based but bound.

There is a second way that this story might seem to achieve some things "too easily." The general picture here features what might be called an inherently *active* view of neural processes, one where endogenous activity and its modulation are emphasized. This is the kind of view that some neuroscientists advocate by way of a contrast with more "passive" views in which a nervous system is a signaling network waiting to be pushed into motion by stimuli from outside (Buzsáki 2006, Brembs 2008). This has its own connections to "explanatory gap" intuitions. Considered as a purely sociological matter, there is a tendency for philosophers and scientists emphasizing the active side of brains, human life, and matter itself to be less worried about the mind-body problem than various others. This might suggest a sort of false progress or illusion of explanation. We perhaps encounter here a quirk of our imaginative and folk-theoretic habits, where we tend to think of anything *active* as *animate*, and hence quasi-mental.

One might view this situation as one where those emphasizing the active side get an unearned intuitive payoff or, alternatively, think that this view of the physical basis of the mind is just better, and the mind-body problem needlessly seems worse for those who start out differently. Both interpretations might contain an element of truth.

I've spent some time discussing ways in which the scenario here bears on the traditional "explanatory gap," but it would be a mistake to put too much weight on this. The "gap" is a *felt* gap, dependent on our sense of explanatory closure. It is also in part a consequence of the harmlessly unclosable difference between first-person and third-person perspectives. Whether or not the story here achieves much intuitive gap-closing in the reader, it shows the shape of a scenario for the evolution of experience that has a gradualist character.

I said that the picture includes a combination of more schematic features related to subjectivity together with particular features of nervous system activity. I don't want to make these look too separate; this is not a situation with a cognitive or functional profile on one side and, as a wholly distinct element, a particular kind of physical realization. The neural activity I've been emphasizing is not just a raw material, something blurry and active inside us, but a means by which new kinds of sensing and action were achieved in animals. A different substrate would do different things.

On that last point, an interesting contrast is provided by the "chemical brain" model developed by Gáspár Jékely (2021) as a model for an evolutionary precursor of nervous systems in the full sense, a hypothesis based on a part of nervous systems that is still present today. A chemical brain, in Jékely's sense, is comprised of excitable cells that influence each other, where specificity of influence is achieved by a comparatively large array of different small peptide signaling molecules and receptors on cells, rather than (as in the familiar case) a small range of signaling molecules with specificity of influence achieved through cell projections and synapses. In a chemical brain, signaling molecules are broadcast widely, and are taken up by any cells with right receptors. (In this way, a chemical brain is a bit like a gene regulatory network.) A partial chemical brain in this sense is, Jékely says, still present in animals like us now, along with more familiar neural structures using synapses. If so, why not use a chemical brain for all nervous system tasks? It would not be hard to generate a large range of signaling molecules through the

combinatorial features of peptides; specificity of influence can probably be scaled up. However, a chemical brain will be much slower than one with projections and synapses, as it is based on diffusion, For the same reason, it can also be expected to have less coherent large-scale dynamic properties – oscillations, and so on – of the kind whose importance is described above. Being made of different parts, it will have different kinds of activity, and will do different things from a brain like ours.

Suppose these ideas do tell us something about experientialization as an evolutionary process. What I have done here is try to give a sketch of one of the hard parts of the gradualist evolutionary story, the part that goes from no to yes, regarding the presence of experience. Much of this story is probably best seen as having a "how possibly" status, although it is supposed to be empirically motivated. Many evolutionary questions do remain unresolved in this area, and some bets I have made may turn out to be misplaced. I opted for a view of early nervous system evolution that puts considerable emphasis on the formation and coordination of action itself. That might be a mistake, as might the ideas about an ancient role for large-scale dynamic patterns in nervous systems. Interestingly, and relevant to the gaps in our knowledge, there are no organisms today that have a semi- or quasi-nervous systems. Animals either have a recognizable nervous system or not, and almost all have them. But nervous systems were almost certainly built slowly, with stages that can be provisionally reconstructed.

Looking again at the more philosophical side, the framework developed here is not one in which some inner light waits to come on. The story is not, or need not be, one where *that thing*, subjective experience, emerges by stages into view. By the end of the process, this familiar part of our lives *has* come into view, but the form of the story can be one where a series of other things gradually arise and are brought together, to yield the state we find at the end. The story also need not include an overall scale of degree of sentience or consciousness. I talked above about the "experientialization" of biological activity, and this does require that something like movement towards an outcome of experience makes sense, but this need not happen along a single line.

The overall shape of this view is one where there are various definite experiential "yes" and "no" cases – ourselves, armchairs, respectively. Experience can also be straightforwardly present in a lot of other animals. But there will also be various

outcomes in the story other than experience itself, seen both in the historical transitions described above and in present-day cases, where some present-day cases may approximate historical stages while others are novel. There are organisms with sensorimotor arcs that are simpler and not neurally organized, organisms with neural patterns of activity that are mostly coordinative rather than organized around subjectivity, and also organisms with combinations that are more like ours. The goings-on inside various other organisms can be "more or less experiential," but to say that is not to posit an overall scale. The situation is not one where a cluster of biological features are put together in a combination and the output is a degree of sentience – 0.6, 0.2 – or even an ordering – flowering plants lower than anemones, higher than sponges. Instead, the situation is one where an organism has its own collection of experience-relevant features. We humans have our own place in this unordered array of ways of being, along with other extant animals, extant non-animals, ancestors, and non-ancestral extinct forms.

I will finish with a note on the much-discussed question of the "function of consciousness," where "function" is understood in a biological, evolutionary sense and "consciousness" is, again, understood broadly. The view outlined here is not one where subjective experience itself has some particular function. Experience arises from a combination of schematic features associated with subjectivity along with the neural basis of these capacities in animals. The first part of this combination comes to exist as a consequence of the evolution of action. Once you build something that acts in the way that animals do, you have built something that acts from a point of view (and so on) – there is no distinct function for this kind of property, over and above what comes about from animal agency. The later-arising and experience-shaping traits discussed earlier in this paper – working memory, higher-order thought, and so on – can all have their own particular biological functions, but they are not the basis for experience itself. Regarding the other part of the story, the part that involves particular features of nervous system activity, there is an evolutionary *reason* for all this to have come about – an explanation for it, in terms of the raw materials animals inherited from earlier kinds of life, the historical roles of nervous systems in coordinating whole-body action, and then the later reshaping and expansion of nervous systems in various parts of the phylogenetic tree. There is a story about why our bodies are steered by control systems of this kind. But

there is not some specific function for this being the way things are; what we're talking about is too broad and old for that.

* * *

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