Is There Something It's Like to Be a Garden Snail?

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Abstract: The question "are garden snails conscious?" or equivalently "is there something it's like to be a garden snail?" admits of three possible answers: yes, no, and denial that the question admits of a yes-or-no answer. All three answers have some antecedent plausibility, prior to the application of theories of consciousness. All three answers retain their plausibility after the application of theories of consciousness. This is because theories of consciousness, when applied to such a different species, are inevitably question-begging and rely partly on dubious extrapolation from the introspections and verbal reports of a single species.

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1. Introduction.

Consciousness might be abundant in the universe, or it might be sparse. Consciousness might be cheap to build and instantiated almost everywhere there's a bit of interesting complexity, or it might be rare and expensive, demanding nearly human levels of cognitive sophistication or very specific biological conditions.

Maybe the truth is somewhere in the middle. But it is a vast middle! Are human fetuses conscious? If so, when? Are lizards, frogs, clams, cats, earthworms? Birch forests? Jellyfish? Could an artificially intelligent robot ever be conscious, and if so, what would it require? Could groups of human beings, or ants or bees, ever give rise to consciousness at a group level? How about hypothetical space aliens of various sorts?

Somewhere in the middle of the middle, perhaps, is the garden snail. I want to focus carefully on just this one organism. Reflection on the details of this case will, I think, illuminate general issues about how to assess the sparseness or abundance of consciousness in the world.

*2. The Options: Yes, No, *Gong*.*

I see three possible answers to the question of whether garden snails are conscious: yes, no, and denial that the question admits of a yes-or-no answer.

To understand what *yes* amounts to, we need to understand what "consciousness" is in the intended sense. Unfortunately, the definition of consciousness is fraught. I have argued, in fact, that since analytic and functional definitions of consciousness are theoretically question-begging, the best way to define consciousness is to provide relatively uncontentious positive and negative examples, then trust that the audience will latch on to the most obvious

property that only the positive examples share (Schwitzgebel 2016; see also Searle 1992; Block 1995; Chalmers 1996; Siewert 1998). So here are some examples: vivid visual imagery of one's house or apartment as viewed from the street, the auditory experience of listening to music, the vivid emotional experience of surging with anger at having been mistreated, the experience of having a song running annoyingly through your head, the experience of thinking about how best to get across town to grandma's house during rush hour, the sudden sting of pain when you stub your toe. I hope it seems clear that all of these examples share an obvious property – a property that is lacking in, for example, early visual processing, the signaling of growth hormone release, and heartbeat regulation (though all of those happen in the brain). This shared property is the property that philosophers refer to as being *phenomenally conscious*, or belonging to the *stream of experience*, or being part of "what it's like" to be you (in Nagel's 1974 sense). If garden snails are conscious, there's something it's like to be them in this sense. They have, maybe, simple tactile experiences of the stuff that they are sliming across, maybe some olfactory experiences of what they are smelling and nibbling, maybe some negative affective experiences when injured.

If, on the other hand, garden snails are not conscious then there's nothing it's like to be one. They are as experientially empty as we normally assume rocks and toy robots to be. Physiological processes occur, just like physiological processes occur in mushrooms and in the human immune system, but these physiological processes don't involve real experiences of any sort. No snail can genuinely *feel* anything. Garden snails might be, as one leading snail researcher expressed it to me, "intricate, fascinating machines", but nothing more than that – or to be more precise, no more conscious than most people assume intricate, fascinating machines to be, which is to say, not conscious at all.

Alternatively, the answer might be neither yes nor no. *The Gong Show* is an amateur talent contest in which performers whose acts are sufficiently horrid are interrupted by a gong

and ushered offstage. Not all yes-or-no questions deserve a yes-or-no answer. Some deserve to be gonged off the stage. "Are garden snails conscious?" might be one such question – for example, if the concept of "consciousness" is a broken concept, or if there's an erroneous presupposition behind the question, or (somewhat differently) if it's a fine question but the answer is in an intermediate middle space between yes and no.

Here's what I'll argue in this essay: Yes, no, and *gong* all have some plausibility to them. Any of these answers might be correct. Each answer has some antecedent plausibility – plausibility before we get into the nitty-gritty of detailed theories of consciousness. And if each answer has some antecedent plausibility, then each answer also has some posterior plausibility – some plausibility *after* we get into the nitty-gritty of detailed theories of consciousness.

Antecedent plausibility becomes posterior plausibility for two reasons. First, there's a vicious circle. Given the broad range of antecedently plausible claims about the sparseness or abundance of consciousness in the world, in order to answer the question of how widespread consciousness is, even roughly, we need a good theory. We need, probably, a well-justified general theory of consciousness. But a well-justified general theory of consciousness is impossible to build without relying on some background assumptions about roughly how widespread consciousness is. Before we can have a general sense of how widespread consciousness is, we need a well-justified theory; but before we can develop a well-justified theory, we need a general sense of how widespread consciousness is. Before X, we need Y; before Y, we need X.

Antecedent plausibility becomes posterior plausibility for a second reason too: Theories of consciousness rely essentially on introspection or verbal report, and all of our introspections and verbal reports come from a single species. This gives us a limited evidence base for extrapolating to very different species.

Contemplate the garden snail with sufficient care and you will discover, I think, that we human beings, in our current scientific condition, have little ground for making confident assertions about one of the most general and foundational questions of the science of consciousness, and indeed one of the most general and foundational questions of all philosophy and cosmology: How widespread is consciousness in the universe?

3. The Brains and Behavior of Garden Snails.

If you grew up in a temperate climate, you probably spent some time bothering brown garden snails (*Cornu aspersum,* formerly known as *Helix aspersa;* Figure 1) or some closely related species of pulmonate (air-breathing) gastropod. Their brains are quite different from and smaller than those of vertebrates, but their behavior is in some ways strikingly complex. They constitute a difficult and interesting case about which different theories yield divergent judgments.

Figure 1. *Cornu aspersum,* the common garden snail. Photo: Bryony Pierce (cropped). Used with permission.

3.1. Snail brains. The central nervous system of the brown garden snail contains about 60,000 neurons (Chase, 2001). That's quite a few more neurons than the famously mapped 302 neurons of the *Caenorhabditis elegans* roundworm, but it's also quite a few less than the quarter million of an ant or fruitfly. Gastropod neurons generally resemble vertebrate neurons, with a few notable differences (Chase 2001, 2002). One difference is that gastropod central nervous system neurons usually don't have a bipolar structure with axons on one side of the cell body and dendrites on the other side. Instead, input and output typically occur on both sides without a clear differentiation between axon and dendrite. Another difference is that although gastropods' small-molecule neural transmitters are the same as in vertebrates (e.g., acetylcholine, serotonin), their larger-molecule neuropeptides are mostly different. Still another difference is that some of their neurons are huge by vertebrate standards.

The garden snail's central nervous system is organized into several clumps of ganglia, mostly in a ring around its esophagus (Kerkut, Lambert, Gayton, Loke, and Walker 1975). Despite their relatively low number of central nervous system neurons, they have about a quarter million peripheral neurons, mostly in their posterior (upper) tentacles, and mostly terminating within the tentacles themselves (Chase 2001). (How relevant peripheral neurons are to consciousness is unclear, but input neurons that don't terminate in the central nervous system are usually assumed to be irrelevant to consciousness.) Figure 2 is a schematic representation of the central nervous system of the closely related species *Helix pomatia*. So far, I have been unable to discover good quantitative estimates of the degree of neural connectivity or neural synchronization across the commissures and connectives between the ganglia in the *Cornu* or *Helix* genus.

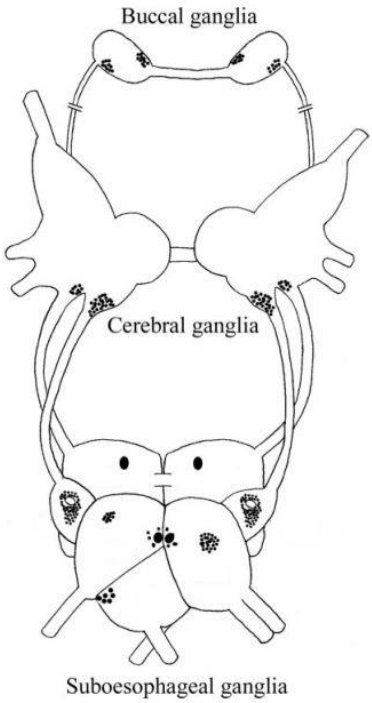

Figure 2. Schematic representation of the central nervous system of *Helix pomatia,* adapted from Casadio, Fiumara, Sonetti, Montarolo, and Ghirardi 2004.

3.2. Snail behavior. Snails navigate primarily by chemoreception, or the sense of smell, and mechanoreception, or the sense of touch. They will move toward attractive odors, such as food or mates, and they will withdraw from noxious odors and tactile disturbance. Although garden snails have eyes at the tips of their posterior tentacles, their eyes seem to be sensitive only to light versus dark and the direction of light sources, rather than to the shapes of objects (Chase 2002; Zieger and Meyer-Rochow 2008). The internal structure of snail tentacles shows much more specialization for chemoreception, with the higher-up posterior tentacles perhaps better for catching odors on the wind and the lower anterior tentacles better for ground and food odors. Garden snails can also sense the direction of gravity, righting themselves and moving toward higher ground to escape puddles. Arguably, at least some pulmonate snails sleep (Stephenson and Lewis 2011).

Snails can learn. Gastropods fed on a single type of plant will preferentially move toward that same plant type when offered the choice in a Y-shaped maze (Croll and Chase 1980; Avila 1998; relatedly, Nitikin, Korshunova, Zakharov, and Balaban 2008). They can also learn to avoid foods associated with noxious stimuli, sometimes even after a single trial (Sahley, Gelperin, and Rudy 1981; Kimura, Toda, Sekiguchi, and Kirino 1998). Some gastropod species will modify their degree of attraction to sunlight if sunlight is associated with tumbling inversion (Crow and Alkon 1978; Lederhendler, Gert, and Alkon 1986). "Second-order" associative learning also appears to be possible: For example, when apple and pear odors are associated and the snails are given the odor of pear but not apple together with the (more delicious) taste of carrot, they will subsequently show more feeding related response to both pear and apple odors than will snails for which apple and pear odors were not associated (Lloyd, Fernández, and Acebes 2006; relatedly, Gelperin 2013; Hawkins and Byrne 2015). The terrestrial slug *Limax maximus* appears to show compound conditioning, able to learn to avoid odors A and B when those odors are combined, while retaining attraction to A and B separately (and also avoiding A, B, and A+B when A and B are presented from different sources placed near each other and associated with noxious stimuli: Hopfield and Gelperin 1989). In *Aplysia californica* "sea hares", the complex role of the central nervous system in governing reflex withdrawals has been extensively studied, partly due to the conveniently large size of some *Aplysia* neurons (the largest of any animal species). *Aplysia californica* reflex withdrawals can be modified centrally – mediated, inhibited, amplified, and coordinated, maintaining a singleness of action across the body and regulating withdrawal according to circumstances (Kandel 2001; Chase 2002). Garden snail nervous systems appear to be at least as complex, generating unified action that varies with circumstance.

Garden snails can coordinate their behavior in response to information from more than one modality at once (Adamo and Chase 1991; Chase 2002). As previously mentioned, when they detect that they are surrounded by water, they seek higher ground. They will cease eating when satiated, balance the demands of eating and sex depending on level of starvation and sexual arousal, and exhibit less withdrawal reflex while mating. Land snails will also maintain a home range to which they will return for resting periods or hibernation, rather than simply moving in an unstructured way toward attractive sites or odors (Lind 1989, 1990; Tomiyama 1992; Stringer, Parrish, and Sherley 2018).

Garden snail mating is famously complex (Herzberg and Herzberg 1962; Chase 2002; Koene 2006). The species is a simultaneous hermaphrodite, playing both the male and female role simultaneously. Courtship and copulation requires several hours. Courtship begins with the snails touching heads and posterior tentacles for tens of seconds, then withdrawing and circling to find each other again, often tasting each other's slime trails, or alternatively breaking courtship. They typically withdraw and reconnect several times, sometimes biting each other. Later in courtship, one snail will shoot a "love dart" consisting of calcium and mucus at the other, succeeding in penetrating the skin about one third of the time. Within some tens of minutes later, the other snail will reciprocate. A dart that lands causes at least mild tissue damage, and occasionally a dart will penetrate a vital organ. Courtship continues regardless of whether the darts successfully land. The vagina and penis are both located on the right side of the snail's body, and are normally not visible until they protrude together, expanding for copulation through a pore in what you might think of as the right side of the neck. Sex culminates when the partners manage to simultaneously insert their penises into each other, which may require dozens of attempts. Each snail transfers a sperm capsule, or spermatophore, to the other. Upon arrival, the sperm swim out and then the receiving partner digests over 99% of them for their nutritional value.

Before egg laying, garden snails use their feet to excavate a shallow cavity in soft soil. They insert their head into the cavity for several hours while they ovulate, then cover the eggs again with soil. This behavior is flexible, varying with soil conditions and modifiable upon disturbance; and in some cases they may even use other snails' abandoned nests (Basinger 1931; Herzberg and Herzberg 1962; Bailey 2010). Garden snails normally copulate with several partners before laying eggs, creating sperm competition for the fertilization of their eggs. Eggs are more likely to be fertilized by the sperm of partners whose love darts successfully penetrated the skin during courtship than by partners whose darts didn't successfully penetrate. The love darts thus appear to function primarily for sperm competition, benefiting the successful shooter at the expense of some tissue damage to its mate (Chase 2002; Koene 2006). The mucus on the dart may protect the sperm of the successful shooter from being digested at as high a rate as the sperm of other partners.

Impressive accomplishments for creatures with a central nervous system of only 60,000 neurons! Of course, snail behavior is limited compared to the larger and more flexible behavioral repertoire of mammals and birds. In vain, for example, would we seek to train snails to engage in complex sequences of novel behaviors, as with pigeons, or rational budgeting and exchange in a simple coin economy, as with monkeys (Chen, Lakshminarayanan, and Santos 2006). (Here I'm interpreting absence of evidence as evidence of absence.)

*4. The Antecedent Plausibilities of Yes, No, and *Gong*.*

Now, knowing all this… are snails phenomenally conscious? Is there something it's like to be a garden snail? Do snails have, for example, sensory experiences? Suppose you touch the tip of your finger to the tip of a snail's posterior tentacle, and the tentacle retracts. Does the snail have tactile experience of something touching its tentacle, a visual experience

of a darkening as your finger approaches and occludes the eye, an olfactory or chematosensory experience of the smell or taste or chemical properties of your finger, a proprioceptive experience of the position of its now-withdrawn tentacle?

4.1. Yes. I suspect, though I am not sure, that "yes" will be intuitively the most attractive answer for the majority of readers. It seems like we can imagine that snails have sensory experiences, and there's something a little compelling about that act of imagination. Snails are not simple reflexive responders but complex explorers of their environment with memories, sensory integration, centrally controlled self-regulation responsive to sensory input, and cute mating dances. Any specific experience we try to imagine from the snail's point of view, we will probably imagine too humanocentrically. Withdrawing a tentacle might not feel much like withdrawing an arm; and with 60,000 central neurons total, presumably there won't be a wealth of experienced sensory detail in any modality. Optical experience in particular might be so informationally poor that calling it "visual" is already misleading, inviting too much analogy with human vision. Still, I think we can conceive in a general way how a theory of consciousness that includes garden snails among the conscious entities might have some plausibility.

To these intuitive considerations, we can add what I'll call the *slippery-slope argument* (adapted from Chalmers 1996, p. 293-295; cf. James 1890/1918, p. 147-148; Goff 2013).

Most people think that dogs are conscious. Dogs have, at least, sensory experiences and emotional experiences, even if they lack deep thoughts about an abiding self. There's something it's like to be a dog. If this seems plausible to you, then think: What kinds of sensory experiences would a dog have? Fairly complex experiences, presumably, matching the dog's fairly complex ability to react to sensory stimuli. Now, if dogs have complex

sensory experiences, it seems unlikely that dogs stand at the lower bound of conscious entities. There must be simpler entities that have simpler experiences.

Similar considerations apply, it seems, to all mammals and birds. If dogs are conscious, it's hard to resist the thought that rats and ravens are also conscious. And if rats and ravens are conscious, again it seems likely that they have fairly complex sensory experiences, matching their fairly complex sensory abilities. If this reasoning is correct, we must go lower down the scale of cognitive sophistication to find the lower limits of animal consciousness. Mammals and birds have complex consciousness. Who has minimal consciousness? How about lizards, lobsters, toads, salmon, cuttlefish, honeybees? Again, all of them in fact have fairly complex sensory systems, so the argument seems to repeat.

If Species A is conscious and Species B is not conscious, and if both species have complex sensory capacities, then one of the following two possibilities must hold. Either (a.) somewhere in the series between Species A and Species B, consciousness must suddenly wink out, so that, say, toads of one genus have complex consciousness alongside their complex sensory capacities, while toads of another genus, with almost as complex a set of sensory capacities, have no consciousness at all. Or (b.) consciousness must slowly fade between Species A and Species B, such that there is a range of intermediate species with complex sensory capacities but impoverished conscious experience, so that dim sensory consciousness is radically misaligned with complex sensory capacities – a lizard, for example, with a highly complex sensory visual field but only a smidgen of visual experience of that field. Neither (a) nor (b) seems very attractive.

If this reasoning is correct, we must go lower down the scale of cognitive sophistication to find the lower limits of animal consciousness. Where, then, is the lower bound? Chalmers suggests that it might be systems that process a single bit of information, such as thermostats. We might not want to go as far as Chalmers. However, since garden

snails have complex sensory responsiveness, sensory integration, learning, and central nervous system mediation, it seems plausible to suppose that the slippery slope stops somewhere downhill of them.

Although perhaps the most natural version of "yes" assumes that garden snails have a single stream of consciousness, it's also I think worth contemplating the possibility that garden snails have not one but rather several separate streams of experience – one for each of their several main ganglia, perhaps, but none for the snail as a whole. Elizabeth Schechter (2018), for example, has argued that "split brain subjects" whose corpus callosum has been almost completely severed, have two separate streams of consciousness, one associated with the left hemisphere and one with the right hemisphere, despite having moderately unified action at the level of the person as a whole in natural environments. Proportionately, there might be as little connectivity between garden snail ganglia as there is between the hemispheres of a split brain subject. Alternatively (or in addition), since the majority of garden snail neurons aren't in the central nervous system at all but rather are in the posterior tentacles, terminating in glomeruli there, perhaps each tentacle is a separate locus of consciousness.

4.2. No. We can also coherently imagine, I think, that garden snails entirely lack sensory experiences of any sort, or any consciousness at all. We can imagine that there's nothing it's like to be a garden snail. If you have trouble conceiving of this possibility, let me offer you three models.

(a.) *Dreamless sleep.* Many people think (though it is disputed) that we have no experiences at all when we are in dreamless sleep. And yet we have some sensory reactivity. We turn our bodies to get more comfortable, and we process enough auditory, visual, and tactile information that we are ready to wake up if the environment suddenly becomes bright or loud or if something

bumps us. Maybe in a similar way, snails have sensory reactivity without conscious experiences.

(b.) *Toy robots.* Most people appear to think that toy robots, as they currently exist, have no conscious experiences at all. There's nothing it's like to be a toy robot. There's no real locus of experience there, any more than there is in a simple machine like a coffeemaker. And yet toy robots can respond to light and touch. The most sophisticated of them can store "memories", integrate their responses, and respond contingently upon temporary conditions or internal states.

(c.) *The enteric nervous system.* The human digestive system is lined with neurons – about a half a billion of them. These neurons form the enteric nervous system, which helps govern motor function and enzyme release in digestion. The enteric nervous system is capable of operating even when severed from the central nervous system. Despite containing as many neurons as the brain of a small mammal, it's not clear that the enteric nervous system is a locus of consciousness.

You might not like these three models of reactivity without consciousness, but I'm hoping that at least one of them makes enough sense to you that you can imagine how a certain amount of functional reactivity to stimuli might be possible with no conscious experience at all. I then invite you to consider the possibility that garden snails are like that – no more conscious than a person in dreamless sleep, or a toy robot, or the enteric nervous system. Possibly – though it's unclear how to construct a rigorous, objective comparison – garden snails' brains and behavior are significantly simpler than the human enteric nervous system or the most complex current computer systems.

To support "no", consider the following argument, which I'll call the *properties of consciousness argument.* One way to exit the slippery slope argument for "yes" is to insist that sensory capacities aren't enough to give rise to consciousness on their own without some further layer of cognitive sophistication alongside. Maybe one needs not only to see but also to be aware *that* one is seeing – that is, to have some sort of meta-representation or self-understanding, some way of keeping track of one's sensory processes. Toads and snails might lack the required meta-cognitive capacities, and thus maybe none of their perceptual processing is conscious.

According to "higher order" theories of consciousness, for example, a mental state or perceptual process is not conscious unless it is accompanied by some (perhaps non-conscious) higher-order representation or perception or thought about the target mental state (e.g., Rosenthal 2005; Gennaro 2012; see also Kriegel 2009 for a related "self-representational" view). Such views are attractive in part, I think, because they so nicely explain two seemingly universal features of human consciousness: its luminosity and its subjectivity. By *luminosity* I mean this: Whenever you are conscious it seems that you are aware that you are conscious; consciousness seems to come along with some sort of grasp upon itself. This isn't a matter of reaching an explicit judgment in words or attending vividly to the fact of your consciousness; it's more like a secondary acquaintance with one's own experience as it is happening. (Even a skeptic about the accuracy of introspective report, like me [Schwitzgebel 2011], can grant the prima facie plausibility of this.) By *subjectivity* I mean this: Consciousness seems to involve something like a subjective point of view, some implicit "I" who is the experiencer. This "I" might not extend across a long stretch of time, or be the robust bearer of every property that makes you "you" – just some sort of sense of a self or of a cognitive perspective. As with luminosity, this sense of subjectivity would

normally not be explicitly considered or verbalized; it just kind of tags along, familiar but mostly unremarked.

Now I'm not sure that consciousness is always luminous or subjective in these ways, even in the human case, much less that luminosity and subjectivity are universal features of every conscious species. But still, there's an attractiveness to the idea. And now it should be clear how to make a case against snail consciousness. If consciousness requires luminosity or subjectivity, then maybe the only creatures capable of consciousness are those who are capable of representing the fact that they are conscious subjects. This might include chimpanzees and dogs, which are sophisticated social animals and presumably have complex self-representational capacities of at least an implicit, non-linguistic sort. But if the required self-representations are at all sophisticated, they will be well beyond the capacity of garden snails.

*4.3. *Gong**. Maybe we can dodge both the yes and the no. Not all yes-or-no questions deserve a yes-or-no answer. This might be because they build upon a false presupposition ("Have you stopped cheating on your taxes?" asked of someone who has never cheated) or it might be because the case at hand occupies a vague, indeterminate zone that is not usefully classified by means of a discrete yes or no ("Is that a shade of green or not?" of some color in the vague region between green and blue). *Gong* is perhaps an attractive compromise for those who feel pulled between the yes and the no, as well as for those who feel that once we have described the behavior and nervous system of the garden snail, we're done with the substance of inquiry and there is no real further question of whether snails also have, so to speak, the magic light of consciousness.

Now I myself don't think that there is a false presupposition in the question of whether garden snails are conscious, and I do think that the question about snail consciousness remains at least tentatively, pretheoretically open even after we have clarified

the details of snail behavior and neurophysiology. But I have to acknowledge that my definition of consciousness – basically, pointing to some examples and saying, "get it?" – may not inspire confidence among the skeptically inclined. It is possible that the concept of consciousness I mean to be employing here doesn't successfully refer to a single phenomenon – that there's no real property of the world that we are mutually discussing when we think we are talking about "phenomenal consciousness" or "what it's like" or "the stream of experience". The most commonly advanced concern about the phrase "consciousness" or "phenomenal consciousness" is that it is irrevocably laden with false suppositions about the features of consciousness – such as its luminosity and subjectivity (as discussed in section 4.2) or its immateriality or irreducibility (Feyerabend 1963; Churchland 1983; Garfield 2015; Frankish 2016; Kammerer forthcoming).

Suppose that I defined a *planimal* by example as follows: Planimal is a biological category that includes oaks, trout, and monkeys, and things like that, but does not include elms, salmon, or apes, or things like that. Then I point at a snail and ask, so now that you understand the concept, is that thing a planimal? *Gong* would be the right reply. Alternatively, suppose I'm talking politics with my Australian niece and she asks if such-and-such a politician (who happens to be a center-right free-market advocate) is a "liberal". A simple yes or no won't do: It depends on what we mean by "liberal". Or finally, suppose that I define a *squangle* as this sort of three-sided thing, while pointing at a square. Despite my attempts at clarification, "consciousness" might be an ill-defined mish-mash category (planimal), or ambiguous (liberal), or incoherent due to false presuppositions (squangle).

It is of course possible *both* that some people, in arguing about consciousness, are employing an ill-defined mish-mash category, or are talking past each other, or are employing an objectionably laden concept *and* that a subgroup of more careful interlocutors has converged upon a non-objectionable understanding of the term. As long as you and I

both belong to that more careful subgroup, we can continue this conversation. I have defined and defended the existence of consciousness at length elsewhere (Schwitzgebel 2016), and I will henceforth assume that we are neither employing a broken concept nor talking past each other.

Quite a different way of defending *gong* is this: You might allow that although the *question* "Is X conscious?" makes non-ambiguous sense, it does not admit of a simple yes-or-no answer in the particular case of garden snails. To the question *are snails conscious?* Maybe the answer is neither *yes* nor *no* but *kind of.* The world doesn't always divide neatly into dichotomous categories. Maybe snail consciousness is a vague, borderline case, like a shade of color might occupy the vague region between green and not-green. This might fit within a general "gradualist" view about animal consciousness (as in Godfrey-Smith 2017, 2020).

However, despite its promise of an attractive escape from our yes-or-no dilemma, the vagueness approach is somewhat difficult to sustain. To see why, it helps to clearly distinguish between being a *little* conscious and being in an indeterminate state between conscious and not-conscious. If one is a little conscious, one is conscious. Maybe snails just have the tiniest smear of consciousness – that would still be consciousness! You might have only a little money. Your entire net worth is a nickel. Still, it is discretely and determinately the case that if you have a nickel, you have some money. If snail consciousness is a nickel to human millionaire consciousness, then snails are conscious.

To say that the dichotomous yes-or-no does not apply to snail consciousness is to say something very different than that snails have just a little smidgen of consciousness. It's to say… well, what exactly? As far as I'm aware, there is no well-developed theory of kind-of-yes-kind-of-no consciousness. We can make sense of vague kind-of-yes-kind-of-no for "green" and for "extravert"; we know more or less what's involved in being a gray-area case

of a color or personality trait. We can imagine gray-area cases with money too: Your last nickel is on the table over there, and here comes the creditor to collect it. Maybe that's a gray-area case of having money. But it's not obvious how to think about gray-area cases of being somewhere between a little bit conscious and not at all conscious. (See also Antony 2008; Simon 2017; Roelofs 2019.)

In the abstract, it is appealing to suspect that consciousness is not a dichotomous property and that garden snails might occupy the blurry in-between region. It's a plausible view that ought to be on our map of antecedent possibilities. However, the view requires conceiving of a theoretical space – in-between consciousness – that has not yet been well explored.

5. Five Dimensions of Sparseness or Abundance.

The question of garden snail consciousness is, as I said, emblematic of the more general issue of the sparseness or abundance of consciousness in the universe. Let me expand upon this general issue. The question of sparseness or abundance opens up along at least five partly-independent dimensions.

(1.) Consciousness might be sparse in the sense that few entities in the universe possess it, or it might be abundant in the sense that many entities in the universe possess it. Let's call this *entity sparseness* or *entity abundance*. Our question so far has been whether snails are among the entities who possess consciousness. Earlier, I posed similar questions about fetuses, dogs, frogs, worms, robots, group entities, the enteric nervous system, and aliens.

(2.) An entity that is conscious might be conscious all of the time or only once in a while. We might call this *state sparseness* or *state abundance*. Someone who accepts state abundance might think that even when we aren't awake or in REM sleep we have dreams or

dreamlike experiences or sensory experiences or at least experiences of some sort. They might think that when we're driving absent-mindedly and can't remember a thing, we don't really blank out completely. In contrast, someone who thinks that consciousness is state sparse would hold that we are often not conscious at all. Consciousness might disappear entirely during long periods of dreamless sleep, or during habitual activity, or during "flow" states of skilled activity. On an extreme state-sparseness view, we might almost never actually be conscious except in rare moments of explicit self-reflection – though we might not notice this fact because whenever we stop to consider whether we are conscious, that act of reflection creates consciousness where none was before. This is sometimes called the "refrigerator light error", after Thomas (1999) who compared it to thinking that the refrigerator light is always on because it's always on whenever you open the door to check to see if it's on.

(3.) Within an entity who is currently state conscious, consciousness might be *modally sparse* or it might be *modally abundant.* Someone who holds that consciousness is modally sparse might hold that people normally have only one or two types of experience at any one time. When your mind was occupied thinking about the meeting, you had no auditory experience of the clock tower bells chiming in the distance and no tactile experience of your feet in your shoes. You might have registered the chiming and the state of your feet non-consciously, possibly even able to remember them if queried a moment later. But it does not follow – not straightaway, not without some theorizing – that such sensory inputs contributed, even in a peripheral way, to your stream of experience before you thought to attend to them. Here again the friend of sparseness can invoke the refrigerator light illusion: Those who are tempted to think that they always experience their feet in their shoes might be misled by the fact that they always experience their feet in their shoes when they think to check whether they are having such an experience. Someone who holds, in contrast, that

consciousness is modally abundant will think that people normally have lots of experiences going on at once, most unattended and quickly forgotten.

(4.) We can also consider *modality width*. Within a modality that is currently conscious in an entity at a time, the stream of experience might be wide or it might be narrow. Suppose you are reading a book and you have visual experience of the page before you. Do you normally only experience the relatively small portion of the page that you are looking directly at? Or do you normally experience the whole page? If you normally experience the whole page, do you also normally visually experience the surrounding environment beyond the page, all the way out to approximately 180 degrees of arc? If you are intently listening to someone talking, do you normally also experience the background noise that you are ignoring? If you have proprioceptive experience of your body as you turn the steering wheel, do you experience not just the position and movement of your arms but also the tilt of your head, the angle of your back, the position of your left foot on the floor? By "width" I mean not only angular width, as in the field of vision, but also something like breadth of field, bandwidth, or richness of information.

(5.) Finally, in an entity at a time within a modality within a band of that modality that is experienced, one might embrace a relatively sparse or abundant view of the *types of properties* that are phenomenally experienced. This question isn't wholly separable from questions of modality sparseness or abundance (since more types of modality suggests more types of experienced property) or modality width (since more possible properties suggests more information), but it is partly separable. For example, someone with a sparse view of experienced visual properties might say that we visually experience only low-level properties like shape and color and orientation and not high-level properties like being a tree or being an inviting place to sit.

To review this taxonomy: Lots of entities might have conscious experiences, or only a few. Within conscious entities, they might be conscious almost all of the time or only rarely. In those moments of consciousness, they might have many modalities of experience at once or only a few. Within a conscious modality of an entity at a particular moment, there might be wide band of experience or only a narrow band. And within whatever band of experience is conscious in a modality in an entity at a time, there might be a wealth of experienced property types or only a few. All of these issues draw considerable debate in consciousness studies.

Back to our garden snail. We can go entity-sparse and say it has no experiences whatsoever. Or we can crank up the abundance in all five dimensions and say that at every moment of a snail's existence, it has a wealth of tactile, olfactory, visual, proprioceptive, and motivation-related experiences such as satiation, thirst, or sexual arousal, tracking a wide variety of snail-relevant properties. Or we might prefer something in the middle, for a variety of ways of being in the middle.

I draw two lessons for the snail. One is that *yes* is not a simple matter: Within *yes,* there are many possible sub-positions.

The other lesson is this. If you can warm up to the idea that human experience might be modality sparse – that people might have some ability to react to things that they don't consciously experience – then that is potentially a path into understanding how it might be the case that snails aren't conscious. If you're not actually phenomenally conscious of the road while you are absent-mindedly driving, well, maybe snail perception is an experiential blank like that. Conversely, if you can warm up to the idea that human experience might be modality abundant, that is potentially a path into how it might be the case that snails are conscious. If we have constant tactile experience of our feet in our shoes, despite a lack of explicit self-reflection about the matter, maybe consciousness is cheap enough that snails can

have it too. Thus, questions about the different dimensions of sparseness or abundance can help illuminate each other.

6. From Antecedent Plausibility to Posterior Plausibility

I have argued that the question "is there something it's like to be a garden snail?" or equivalently "are garden snails conscious?" admits of three possible answers – yes, no, and *gong* – and that each of these answers has some antecedent plausibility. That is, prior to detailed theoretical argument, all three answers should be regarded as viable possibilities (even if we have a favorite). To settle the question, we need a good theoretical argument that would reasonably convince people who are antecedently attracted to a different view. (See Carruthers 2019, ch. 3, for a similar meta-theoretical position.)

It is difficult to see how such an argument could go, for two reasons: (1.) lack of sufficient theoretical common ground and (2.) the species-specificity of introspective and verbal evidence.

6.1. The Common Ground Problem. Existing theories of consciousness, by leading researchers, range over practically the whole space of possibilities concerning sparseness or abundance. On the one end, some major theorists endorse panpsychism, according to which experience is ubiquitous in the universe, even in microparticles (Strawson 2006; Goff 2017). On the other end, other major theorists advocate very restrictive views that deny that dogs are conscious (Carruthers 2000; maybe Dennett 1996) or that it is not determinately the case that dogs are conscious (Carruthers 2019; maybe Papineau 2003). (I exclude from discussion here eliminativists who argue that nothing in the universe is conscious in the relevant sense of "conscious". I regard that as, at root, a definitional objection of the sort discussed in my treatment of the *gong* answer.) The most common (and, despite their simplicity and

seeming naiveté, possibly the best[1]) arguments against these extreme views illustrate the common ground problem.

The most common argument against panpsychism – the reason most people reject it, I suspect – is just that it seems absurd to suppose that protons could be conscious. We know, we think, prior to our theory-building, that the range of conscious entities does not include protons. Some of us – including those who become panpsychists – might hold that commitment only lightly, ready to abandon it if presented attractive theoretical arguments to the contrary. However, many of us strongly prefer more moderate views. We feel, not unreasonably, more confident that there is nothing it is like to be a proton than we could ever be that a clever philosophical argument to the contrary was in fact sound. Our Bayesian priors, so to speak, begin in a different place. Thus, we construct and accept our moderate views of consciousness partly from the starting background assumption that consciousness isn't *that* abundant. If a theory looks like it implies proton consciousness, we reject the theory rather than accept the implication; and no doubt we can find some dubious-enough step in the panpsychist argument if we are motivated to do so.

Similarly, the most common argument against extremely sparse views that deny consciousness to dogs is that it seems absurd to suppose that dogs are not conscious. We know, we think, prior to our theory-building, that the range of conscious entities includes dogs. Some of us might hold that commitment only lightly, ready to abandon it if presented attractive theoretical arguments to the contrary. However, many of us strongly prefer moderate views. We are more confident that there is something it is like to be a dog than we

[1] My view on the epistemic value of pretheoretic intuitive appeal on issues of consciousness is complicated. On the one hand, there is excellent reason to think at our intuitions are unreliable in this domain and probably even form a contradictory set, such that something that seems "crazy" must be true. On the other hand, I don't think we have any clearly *better* grounds for resolving such disputes than intuition, so we can't escape relying on it. See Schwitzgebel 2014a.

could ever be that a clever philosophical argument to the contrary was in fact sound. Thus, we construct and accept our moderate views of consciousness partly on the starting background assumption that consciousness isn't *that* sparse. If a theory looks like it implies that there's nothing it's like to be a dog, we reject the theory rather than accept the implication; and no doubt we can find some dubious-enough step in the argument if we are motivated to do so.

In order to develop a general theory of consciousness, one needs to make some initial assumptions about the approximate prevalence of consciousness.[2] Some theories, from the start, will be plainly liberal in their implications about the abundance of consciousness. Others will be plainly conservative. Such theories will rightly be unattractive to people whose initial assumptions are very different; and if those initial assumptions are sufficiently strongly held, theoretical arguments with the type of at-best-moderate force that we normally see in the philosophy and psychology of consciousness will be insufficiently strong to reasonably dislodge those initial assumptions.

If the differences in initial starting assumptions were only moderately sized, there might be enough common ground to overcome those differences after some debate, perhaps in light of empirical evidence that everyone can, or at least should, agree is decisive. However, in the case of theories of consciousness, the starting points are too divergent for this outcome to be likely, barring some radical reorganization of people's thinking. Your favorite theory might have many wonderful virtues! Even people with very different perspectives might love your theory. They might love it as a theory of *something else,* not phenomenal consciousness – a theory of information, or a theory of reportability, or a theory

[2] If *assumption* seems like the wrong concept here, we can substitute background sense of plausibility, which helps determine whether to accept *modus ponens* or *modus tollens* once you realize your currently favored theory implies the consciousness or non-consciousness of such-and-such an entity. See also Buchanan and Roelofs 2019 on the "Great Chain of Being".

of consciousness-with-attention, or a theory of states with a certain type of cognitive-functional role.

For example, Integrated Information Theory is a lovely theory of consciousness (Oizumi, Albantakis, and Tononi 2014). Well, maybe it has a few problems (Aaronson 2014; Schwitzgebel 2014; Bayne 2018; Doerig, Schurger, Hess, and Herzog 2019; Barrett and Mediano 2019; Hanson 2020), but it is renowned, and it has a certain elegance. It is also very nearly panpsychist, holding that consciousness is present wherever information is integrated, even in tiny little systems with simple connectivity, like simple structures of logic gates. For a reader who enters the debates about consciousness attracted to the idea that consciousness might be sparsely distributed in the universe, it's hard to imagine any sort of foreseeably attainable evidence that ought rightly to lead them to reject that sparse view in favor of a view so close to panpsychism. They might love IIT, but they could reasonably regard it as a theory of something other than conscious experience – a valuable mathematical measure of information integration, for example.

Or consider a moderate view, articulated by Zohar Bronfman, Simona Ginsburg, and Eva Jablonka (2016). Bronfman and colleagues generate a list of features of consciousness previously identified by consciousness theorists, including "flexible value systems and goals", "sensory binding leading to the formation of a compound stimulus", a "representation of [the entity's] body as distinct from the external world, yet embedded in it", and several other features (p. 2). They then argue that all and only animals with "unlimited associative learning" manifest this suite of features. The sea hare *Aplysia californica,* they say, is not capable of unlimited associative learning because it is incapable of "novel" actions (p. 4). Insects, in contrast, are capable of unlimited associative learning, Bronfman and colleagues argue, and thus are conscious (p. 7). So there's the line!

It's an intriguing idea. Determining the universal features of consciousness and then looking for a measureable functional relationship that reliably accompanies that set of features – theoretically, I can see how that is a very attractive move. But why *those* features? Perhaps they are universal to the human case (though even that is not clear), but it's doubtful that someone antecedently attracted to a more liberal theory is likely to agree that flexible value systems are necessary for low-grade consciousness. If you like snails… well, why not think they have integration enough, learning enough, flexibility enough? Bronfman and colleagues' criteria are more stipulated than argued for. One might reasonably doubt this starting point, and it's hard to see what later moves can be made that ought to convince someone who is initially attracted to a much more abundant or a much sparser view. (For some similar arguments, see Michel 2019 on bony fish, Friedman and Søvik forthcoming on ant colonies, and, more optimistically, Birch forthcoming on bees. For a lengthier – but still fundamentally stipulative – treatment of the view articulated in Bronfman et al., see Ginsburg and Jablonka 2019.[3])

Even a "theory light", "abductive", or "modest theoretical" approach (Tye 2017; Birch forthcoming; Shevlin forthcoming) that aims to dodge heavy theorizing up front needs to start with some background assumptions about the kinds of systems that are likely to be conscious or the kinds of behaviors that are likely to be reliable signs. In this domain,

[3] Reading Ginsburg and Jablonka 2019 after having already circulated a nearly final manuscript version of the present paper, I was surprised and interested to discover that Ginsburg and Jablonka express uncertainty about in *Helix* snails and *Limax* slugs specifically. Terrestrial gastropods' somewhat sophisticated but probably not "unlimited" associative learning, Ginsburg and Jablonka argue, puts them in the "gray area" such that it's "possible… [that they have] very low-level consciousness" (p. 395). One concern for both Ginsburg and Jablonka's and Birch's approaches is that they appear to require commitment to a natural clustering of certain types of capacities, such that conscious animals have one cluster of capacities and nonconscious animals lack that cluster. This is an empirically risky conjecture. For example, although I don't think the evidence is decisive, gastropods might have trace conditioning (Hawkins, Lalevic, Clark, and Kandel 1989), often interpreted as a sign of consciousness in humans and other animals, but not rapid reversal learning (Hawkins, Cohen, and Kandel 2006).

people's theoretical starting points are so far apart that these assumptions will inevitably be contentious and rightly regarded as question-begging by others who start at a sufficient theoretical distance.

The challenges multiply when we consider Artificial Intelligence systems and possible alien minds, where the options span a considerably wider combinatorial range. AIs and aliens might be great at some things, horrible at others, and structured very differently from anything we have so far seen on Earth. This expands the opportunities for theorists with very different starting points to reach intractably divergent judgments.

Not all big philosophical disputes are like this. In applied ethics, we start with quite a lot of common ground. Even ancient Confucianism, which is about as culturally distant from the 21st-century West as one can get and still have a large written tradition, shares a lot of moral common ground with us. It's easy to agree with much of what Confucius says. In epistemology, we agree about a wide range of cases of knowledge and non-knowledge, and good and bad justification, which can serve as shared background for building general consensus positions. Debates about the abundance or not of consciousness differ from most philosophical debates in having an extremely wide range of reasonable starting positions and little common ground by which theorists near one end of the spectrum can gain non-question-begging leverage against theorists near the other end. (Continuing the comparison with epistemology, the intractability of radical skepticism is an exception that illustrates the rule: If we include radical skeptics among our interlocutors, the common ground problem risks becoming insurmountable.)

Question-begging theories might, of course, be scientifically fruitful and ultimately defensible in the long run if sufficient convergent evidence eventually accumulates. There might even be some virtuous irrationality in excessive confidence.

6.2. The Species-Specificity of Verbal and Introspective Evidence. The study of consciousness appears to rely, partly, but in an essential way, on researchers' or participants' introspections or verbal reports, which need somehow to be related to physical or functional processes. We know about dream experiences, inner speech, visual imagery, and the boundary between subliminal and superliminal sensory experiences partly because of what people judge or say about their experiences. Despite disagreements about ontology and method, this appears to be broadly accepted among theorists of consciousness (e.g., Dennett 1991; Goldman 1997; Chalmers 2004; Hatfield 2005/2009; Piccinini 2003; Hurlburt 2011; Tsuchiya, Frässle, Wilke, and Lamme 2016; Overgaard 2017). I have argued elsewhere that introspection is a highly unreliable tool for learning about general structural features of consciousness, including the sparseness or abundance of human experience (Schwitzgebel 2011). However, even if we grant substantial achievable consensus about the scope and structure of *human* consciousness, and how it relates to human brain states and psychological function, inferring beyond our species to very different types of animals involves serious epistemic risks.

Behavior and physiology are directly observable (or close enough), but the presence or absence of consciousness must normally be inferred – or at least this is so once we move beyond the most familiar cases of intuitive consensus. However, the evidential base grounding such inferences is limited. All (or virtually all?[4]) of our introspective and verbal evidence comes from a single species. The farther we venture beyond the familiar human case, the shakier our ground. We have to extrapolate far beyond the scope of our direct introspective and verbal evidence. Perhaps an argument for extrapolation to nearby species

[4] A nuance: No-report paradigms and "introspective" metacognitive paradigms are sometimes used with monkeys. However, their interpretation is conjectural and highly theory-laden, and in any case they don't much widen the range of studied species. Recent discussions include Block 2019, 2020; Hampton 2019; Phillips and Morales 2020.

(apes? all mammals? all vertebrates?) can be made on grounds of evolutionary continuity and morphological and behavioral similarity – if we are willing (but should we be willing?) to bracket concerns from advocates of entity-sparse views. Extrapolating beyond the familiar cases to snails (or robots, or weirdly structured aliens – especially if they are incapable of interpretable speech) will inevitably be conjectural and uncertain (see also Nagel 1974; Block 2002/2007; Papineau 2003). Extrapolations to nearby cases that share virtually all properties that are likely to be relevant (e.g., to other normally functioning adult human beings) are more secure than extrapolations to farther cases with some potentially relevant differences (e.g., to mice and ravens) which are in turn more secure than extrapolations to phylogenetically, neurophysiologically, and behaviorally remote cases that still share some potentially relevant properties (garden snails). The uncertainties involved in the last of these provide basis for ample reasonable doubt among theorists who are antecedently attracted to very different views.

Let's optimistically suppose that we learn that, in humans, consciousness involves X, Y, and Z physiological or functional features. Now, in snails we see X', Y', and Z', or maybe W and Z". Are X', Y', and Z', or W and Z", close enough? Maybe consciousness in humans requires recurrent neural loops of a certain sort (Humphrey 2011; Lamme 2018). Well, the snail nervous system has some recurrent processing too. But of course it doesn't look either entirely like the recurrent processing that we see in the human case when we are conscious, nor entirely like the recurrent processing that we see in the human case when we're not conscious. Or maybe consciousness involves availability to, or presence in, working memory or a "global workspace" (Baars 1988; Dehaene and Changeux 2011; Prinz 2012). Well, information travels broadly through the snail central nervous system, enabling coordinated action. Is that global workspace enough? It's like our workspace in some ways, unlike it in others. In the human case, we might be able to – if things go very well! – rely on

introspective reports to help ground a great theory of *human* consciousness. But without the help of snail introspections or verbal reports, it is unclear how we should then generalize such findings to the case of the garden snail.

So we can imagine that the snail is conscious, extrapolating from the human case on grounds of properties we share with the snail; or we can imagine that the snail is not conscious, extrapolating from the human case on grounds of properties we don't share with the snail. Both ways of doing it seem defensible, and we can construct attractive, non-empirically-falsified theories that deliver either conclusion. We can also think, again with some plausibility, that the presence of some relevant properties and the lack of other relevant properties makes it a case where the human concept of consciousness fails to determinately apply.

7. Conclusion.

Maybe we can figure it all out someday. Science can achieve amazing things, given enough time. Who would have thought, a few centuries ago, that we'd have mapped out in such detail the first second of the Big Bang? Our spatiotemporal evidential base is very limited; the cosmological possibilities may have initially seemed extremely wide open. We were able to overcome those obstacles. Possibly the same will prove true, in the long run, with consciousness.

Meanwhile, though, I find something wonderful in not knowing. There's something fascinating about the range of possible views, all the way from radical abundance to radical sparseness, each with its merits. While I feel moderately confident – mostly just on intuitive commonsense grounds, for whatever that's worth – that dogs are conscious and protons are not, I find myself completely baffled by the case of the garden snail. And this bafflement I feel reminds me how little non-question-begging epistemic ground I have for favoring one

general theory of consciousness over another. The universe might be replete with consciousness, down to garden snails, earthworms, mushrooms, ant colonies, the enteric nervous system, and beyond; or consciousness might be something that transpires only in big-brained animals with sophisticated self-awareness.

There's something marvelous about the fact that I can wander into my backyard, lift a snail, and gaze at it, unsure. Snail, you are a puzzle of the universe in my own garden, eating the daisies![5]

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