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Consciousness without biology: An argument from anticipating scientific progress

Leonard Dung (leonard.dung@rub.de)

Abstract

I present two arguments for the view that it is nomologically possible that some non-biological creatures are conscious, including conventional, silicon-based AI systems. They assume the iterative natural kind (INK) strategy, according to which one should investigate consciousness by treating it as a natural kind which iteratively explains observable patterns and correlations between potentially consciousness-relevant features. Both arguments are based on the insight that we can already anticipate that future developments would give us reasons to attribute consciousness to some non-biological creatures. According to the first argument, the fact that we can predict that ordinary people would be compelled to attribute consciousness to some possible non-biological creatures supports the view that these creatures are conscious. According to the second argument, an idealized scientific investigation – based on the INK strategy – would deliver the result that some possible non-biological creatures are conscious, and the outcome of such an ideal application corresponds to what is actually the case. My argument for the former premise is based on the claim that theoretical virtues and pre-theoretical principles support attributing consciousness to psychological duplicates, i.e., non-biological creatures which share the coarse-grained functional organization of humans. Finally, I argue that my second argument can be generalized beyond the INK strategy.

1. Introduction

Due to progress in AI, the question when artificial systems might be phenomenally conscious[1] has received increasing attention and scrutiny. Researchers examine what theories of consciousness imply for the distribution of artificial consciousness (Butlin et al. 2023), what empirical tests for artificial consciousness might be (Dung 2023; Elamrani and Yampolskiy 2019; Perez and Long 2023), and what the ethical significance of questions of artificial consciousness is (Birch 2024; Ladak 2023; Saad and Bradley 2022).

A central point of contention is whether consciousness requires biological processes (Saad 2024, see also footnote 2 in that paper). On *biological substrate views*, creatures can only

[1] A creature is phenomenally conscious if and only if there is something it is like to be it, it has subjective experience, and it has a first-person point of view. These three conditions are equivalent. For brevity, I will omit the qualifier "phenomenal" henceforth.

be conscious if they possess a biological, carbon-based substrate (for this distinction, see Sebo and Long 2023). That is, implementing the right functions is not sufficient for consciousness; instead, conscious creatures need to be made out of the right kind of material. An example is a view which posits that consciousness is type-identical to a certain brain state (Place 1956; Smart 1959), and type-individuates brain states partly in terms of the biological material they are composed from. According to the *biological function view*, realizing certain fine-grained biological functions is necessary for consciousness (Cao 2022; Godfrey-Smith 2016, 2020; Seth 2021). These functions could be having a metabolism, system-wide synchronization or oscillation properties, or other functions whose implementation depends on specifics of the physical features of neurons or brain biochemistry. Some other views tie consciousness not explicitly to biological processes, but nevertheless posit constraints on the substrates or functions of consciousness which conventional silicon-based computing systems cannot fulfill, while biological organisms can (Piccinini 2021; Shiller 2024; Wiese 2024; Wiese and Friston 2021). I will call all these positions "biological views of consciousness". I will call creatures "non-biological" when they do not satisfy the necessary conditions on consciousness these views posit because they are not made from biological (or other suitable) material.

The divide between biological and non-biological views seems to be the most important determinant for researchers' views on the prospects of artificial consciousness. On biological views, artificial consciousness is probably far in the future, if is at all possible. Moreover, if conscious artificial systems are developed, they will not conform to currently dominant AI paradigms. Neural organoids (Birch 2023) and molecular computers (Brunet and Halina 2020) are better candidates. By contrast, Butlin et al. (2023) base their report on computationalism about consciousness which entails that biology is not necessary for consciousness. Accordingly, their analysis concludes that, while no AI systems of their time of writing are conscious, "there are no obvious barriers to building conscious AI systems" (ibid.).

In this paper, I will develop a new argument against biological views: the *anticipatory argument*. In short, I argue that we can already anticipate the following: When scientists investigate consciousness by use of common and justified scientific methods and, thus, our knowledge of consciousness increases, they will eventually – at the hypothetical end of an ideal investigation – conclude that non-biological creatures can be conscious. I argue that this provides us with a compelling reason to already adopt the conclusion that non-biological creatures, including conventional AI, can be conscious.

In section 2, I sketch the iterative natural-kind strategy as approach to the scientific investigation of consciousness. I assume that it captures, on a high level, how consciousness

should be investigated scientifically. In section 3, I develop an anticipatory argument from folk psychology: I suggest that ordinary people would feel compelled to believe that some non-biological AI systems can be conscious, if they encountered such creatures, and that – realizing this – we should be more inclined to believe in the possibility of non-biological consciousness now. This paves the way for the core argument of this paper (in section 4): an anticipatory argument from consciousness science. I argue that we can foresee that an ideal scientific process, based on the iterative natural kind strategy, converges on the view that non-biological AI consciousness is possible. Section 5 generalizes the argument of the previous section: Approaches to consciousness science beyond the iterative natural kind strategy also support the view that biological views of consciousness are false.

2. The iterative natural kind strategy in consciousness science

The iterative natural kind (INK) strategy consists in treating consciousness as a natural kind which iteratively explains observable patterns and correlations between potentially consciousness-relevant features (Bayne et al. 2024; Bayne and Shea 2020; Birch 2022; Boyle n.d.; Mckilliam n.d.; Shea 2012). Grouping entities in terms of natural kinds means classifying them according to underlying, not socially constructed, similarities and differences in their natures (Bird and Tobin 2023). According to this strategy, researchers should search for clusters of effects and capacities which may be related to consciousness and iteratively apply inference to the best explanation to confirm the underlying causal processes and mechanisms.

To find such clusters, researchers need to agree on some measures of consciousness, without being able to already presuppose a comprehensive theory of consciousness (since such measures are necessary to support such a theory in the first place). Such measures have to be established based on pre-theoretical principles (Michel 2023). Such principles include (principle 1) "[t]he better one sees something, the more likely one is to be conscious of it" (ibid., p. 837) and (principle 2) "people can usually tell whether they are conscious of something or not" (ibid., p. 838). The former explains why perceptual discrimination is a pre-theoretical measure of consciousness with some degree of epistemic standing, the latter does the same for metacognitive verbal report (e.g. "I saw the stimulus"). These can then be used to evaluate and improve ("calibrate") further measures of consciousness, i.e., features which – as measured by the preceding criteria – are robustly caused by conscious experience. For example, Birch (2022) proposes trace conditioning, reversal learning, and cross-modal learning as measures of consciousness in animals, since they seem to be facilitated by consciousness in humans, when the latter is measured by verbal report.

Importantly, Michel (2023) explains how pre-theoretical principles can be used to calibrate, including possibly to revise, our initial measures of consciousness, including verbal report. For instance, based on principle 1 (and other background information) we can identify cases where subjects are very likely conscious of a stimulus. If a subject verbally reports that it is not conscious of this stimulus, and particularly if we have additional reason to distrust a subject's report (for example, damage to brain areas involved in metacognitive judgement, a neural response which is similar to the neural response to conscious stimuli, or the presence of a wide range of other potentially consciousness-related abilities), then this may point to cases where verbal report is not a valid measure of consciousness (Mckilliam n.d.).

Once we have a large variety of measures of consciousness, they can be used to calibrate each other. Moreover, we can examine how they covary. If two measures are both measures of consciousness, their results should agree. So, if many of them cluster, this is evidence that there is an underlying natural kind – consciousness – which explains such clustering. This process can also weaken our confidence that certain features are measures of consciousness: for example, if they don't cluster with other measures we are confident in or if our growing theoretical understanding of the consciousness kind suggests that these are the wrong types of features to measure consciousness.[2] This process of mutual correction is iterative, it applies to all our measures and models of consciousness, and it is driven by considerations "of theoretical unification, simplicity, explanatory power, and predictive success" (Bayne et al. 2024).

The INK strategy has been prominently advocated for and defended as a methodology for consciousness science. It is plausible that this strategy describes how consciousness should be researched, since it seems – on a high level of abstraction – to describe the standard approach for scientific investigation, at least in domains like physics (Chang 2004) and biology which deal with natural kinds (as opposed to, e.g., sociology). While it is not guaranteed that consciousness turns out to be a natural kind,[3] the INK strategy has the resources to test whether it is one.

There are disagreements between proponents of the INK strategy, particularly with respect to the measures or principles which form our initial starting point to get the process of calibration of measures going (see Mckilliam n.d., section 4 for a brief overview). However,

[2] This is related to *model calibration* which calibrates a measure by developing a better model of how the measure works and what it would output in certain situations if it was accurate (Michel 2023, p. 834).

[3] The features which are pre-theoretically linked to consciousness may, for example, form a heterogenous array, which is not bound together by a few underlying causal mechanisms. However, this arguably seems relatively unlikely, since consciousness science has already discovered many robust correlations between consciousness and other (behavioral, psychological, as well as neural) features. Eliminativism about consciousness (Frankish 2016; Irvine and Sprevak 2020) – the view that consciousness does not exist – would also imply that there is no natural kind of consciousness.

the basic guidelines of the strategy are agreed-upon: 1. Use pre-theoretical principles to establish an initial set of measures of consciousness with at least minimal epistemic standing. 2. Use these measures to calibrate each other and to establish and calibrate further "derived" measures of consciousness. 3. Use these measures to search for clusters of consciousness-related features. 4. Iteratively apply inference to the best explanation to confirm the underlying natural kind which may underly consciousness as well as to further calibrate proposed measures.

When applied to non-human consciousness, it has been suggested to perform the INK strategy hierarchically (Bayne et al. 2024): When validating measures of consciousness, we start with neurotypical, adult humans as a population where consciousness is agreed-upon (step 1). In step 2, we see whether different measures also correlate in a new population (for example, human infants or non-human mammals), including new measures that are only applicable to that population. Then, we increase our credences in measures, including the ones from step 1, where correlations are preserved and decrease it in others. Subsequently, we again apply the measures to new populations, working our way downwards from the human case where there is consensus about the presence of consciousness until we reach hotly contested cases (e.g. invertebrates or AI).

In the next section, I will present a first, more tentative argument for the possibility of consciousness in non-biological creatures. This argument derives support from the role pre-theoretical principles play in the INK strategy. I will present my main argument in section 4 based on further elements of the INK strategy. However, I will argue in section 5 that my conclusion is not dependent on assuming the INK strategy: It also holds given other plausible accounts of how to investigate non-human consciousness.

3. The anticipatory argument from folk psychology

Henceforth, when not specified otherwise, "possible", and synonymous notions, mean "nomologically possible": compatible with the laws of nature.[4] When not specified otherwise, "AI system" refers to conventional, silicon-based and non-biological systems, not AI systems made from unusual material (e.g. morphological computers). Here is my first argument:

The anticipatory argument from folk psychology

P1. There are possible AI systems which ordinary people feel compelled to attribute consciousness to.

[4] For reasons why nomological possibility is most relevant in this context, see Saad (2024).

P2. If there are possible AI systems which ordinary people feel compelled to attribute consciousness to, then there are possible AI systems which are conscious.

C. There are possible AI systems which are conscious.

The argument is valid, so let us talk about the premises. P1 expresses the view that there are possible non-biological systems which humans would treat as certainly conscious. These include conventional, silicon-based AI systems. P1 can be supported via this assumption:
Psychological Duplication: Psychological duplicates are possible.

Let me stipulate that psychological duplicates are non-biological creatures which are made from the same material as conventional AI systems and share all coarse-grained functional as well as behavioral properties of normal conscious humans. So, psychological duplicates are behaviorally equivalent to normal conscious humans: they exhibit the same behavior in all possible situations. Coarse-grained functional equivalence is harder to spell out. Functional properties are individuated by their causal role, i.e., by input-output mappings. The functional properties of the human brain can be characterized on various levels of abstractions. On a very fine-grained level, it is possible to talk about the causal roles played by individual neurons, their sub-neural components, and brain biochemistry. On such a fine-grained level, it may not be nomologically possible (Cao 2022), and even more likely is not practically feasible, that conventional computer hardware duplicates the functional properties of brains.

An example of a coarse-grained level is the computational level of description (Marr 1982). Here, the brain can be understood in terms of the high-level tasks, characterized as mathematical functions, it solves and the algorithms, operating over representations, it implements to solve these tasks.[5] On the computational level, it is plausible that psychological duplicates are possible. It is common in cognitive science to describe humans as storing representations and processing them using algorithms which are characterized independently of neural properties and can thus also be implemented by AI systems.

While the computational level is one example for a coarse-grained functional description of the brain, there may be other levels of functional abstraction which are coarse-grained enough that duplication of the functioning of the human brain is possible on that level, and which are fine-grained enough that this duplication – in an interesting sense – duplicates human "psychology". So, psychological duplicates are AI systems that mirror the coarse-

[5] Marr (1982) calls the latter the "algorithmic level".

grained functions, i.e. abstractly causally described causal processes, of humans, while the exact fineness of grain on which this duplication is possible is up for debate.

Coarse-grained functional equivalence implies behavioral equivalence: if a system implements the same functions as the human mind, then it produces the same outputs, given the same inputs. Moreover, the same behavior can be produced by a wide variety of mechanisms. For these reasons, it is relatively uncontroversial that AI systems which are behaviorally equivalent to humans are (nomologically) possible.[6]

Crucially, Psychological Duplication is a weaker assumption than the assumption that biological views of consciousness are false. The debate between biological and non-biological views is about whether coarse-grained functional duplicates of humans are conscious or whether something is missing: a biological substrate, fine-grained biological functions, or some other property which cannot be possessed by systems made from silicon-based material. Proponents of biological views can grant that psychological duplicates are possible, and they need additional arguments to motivate the view that they are not possible.

Specifically, proponents of biological views should endorse Psychological Duplication if they think consciousness' dependence on particular physical substrates is something distinctive of consciousness, not shared by other mental states. Hence, Psychological Duplication is also supported by views which hold that other mental capacities can be possessed by AI – like agency (Dung 2024) or concepts (Butlin 2021) – or that computational models implement key components of cognitive processes such as episodic memory (Boyle and Blomkvist n.d.) or attention (Lindsay 2020). For, if these views are true, human and AI cognition must have coarse-grained functional similarities sufficient to share (key components of) central cognitive states.

So, I will assume from now on that psychological duplicates are possible.[7] Such creatures would talk and interact with us – over their whole life span – in the same ways as our fellow humans. In addition, there is no reason why psychological duplicates could not have a body which mirrors human outward appearance, including facial expressions and outside material which feels like human skin. So, let us assume this too.

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[6] Behavioral duplicates might not be possible, if one individuates behavior very finely, e.g. counting very precise patterns of physiological responses as types of behavior. However, the notion of behavior relevant for my argument is coarse-grained.

[7] Suppose one denies that psychological duplicates are possible: If one grants that there are any possible creatures which are behaviorally and computationally equivalent to humans and don't have biological properties, even if no silicon-based AI systems are among them, then one can still use the arguments in this paper to conclude that some possible creatures without biology are conscious, even if it may be that no silicon-based AI systems can be conscious. Also, versions of the arguments of this paper which refer to possible creatures which are merely behaviorally equivalent to humans may also be plausible.

It is obvious that everyone would have a strong sense that these creatures are conscious. Psychologically, the urge to treat such psychological duplicates as fellow conscious beings would be just as strong as the urge to treat other humans as conscious. After all, they look, feel, and behave the same. This would be sufficient such that everyone attributes consciousness to these creatures. This can be seen by the commonplace that people's judgement that other humans are conscious does not depend on scientific evidence: it is something people take to be self-evident and do not question.[8] Scientific evidence could not overwrite this judgement. In a case of scientific uncertainty about whether psychological duplicates can be conscious (due to open questions about the necessary conditions for consciousness), it seems clear that virtually all humans would regard them as conscious.

P2 expresses the view that people's judgements about psychological duplicates are truth-tracking: If humans are compelled to treat psychological duplicates as conscious, this gives us sufficient reason to think that they are conscious.[9] One route to this conclusion proceeds by using a so-called Moorean argument (Sampson 2023): If we encountered psychological duplicates, it would be self-evident to us that they are conscious. Thus, the assumption that psychological duplicates are conscious arguably has a higher epistemic standing than any sophisticated theoretical argument to the contrary might have. With respect to the justification that a Moorean argument provides, it seems irrelevant that we do not regard it as self-evident *right now* that psychological duplicates are conscious before we have encountered them. Encountering psychological duplicates gives us new relevant information. If we can predict that, with more information, we would be justified to conclude that psychological duplicates are conscious, we should already adjust our beliefs.

A different argument is that, as we have seen, consciousness science itself rests on pre-theoretical principles (see also Shevlin n.d., sect. 3.2). Arguably, such principles support the view that psychological duplicates are conscious. The first reason for thinking that pre-theoretical principles support that psychological duplicates are conscious is that already established principles, like principle 1 and 2, point in this direction, because psychological duplicates can both see stimuli and verbally report them. To avoid this conclusion, one could interpret principle 1 and 2 such that they only apply to *human* vision and verbal report, but – given that psychological duplicates are just as good at seeing and reporting – it is not clear why to do that. One could reply that human verbal report can be taken as a basis, because there is consensus about human consciousness, while there is none about psychological duplicates.

[8] In accordance with this, the concern that other humans might not be conscious has mostly been taken as a skeptical challenge in need of a philosophical resolution, not as a serious hypothesis (Avramides 2023).
[9] For exploration of a similar view, see Shevlin (n.d.).

However, given P1, there would be consensus in that everyone will be compelled to attribute consciousness to psychological duplicates. So, a further argument would be needed for why we are justified to trust our pre-theoretical judgement that other humans are conscious, but not that psychological duplicates are conscious.

The second reason for thinking that pre-theoretical principles support that psychological duplicates are conscious is that some pre-theoretical principles might explicitly specify which creatures are conscious, or not conscious. In the INK strategy, views about what underlying processes explain consciousness, how consciousness is measured, and which creatures are conscious are tested and revised in dependence on one another. Given this interdependence, there is no reason why pre-theoretical principles can only apply directly to measures. Arguably, principles regarding which creatures are conscious also have an important pre-theoretical role: they indirectly inform what plausible measures of consciousness might be, and they help us to narrow down what kind of property consciousness – the explanandum of the science of consciousness – is. Principle 1 and 2 seem to even presuppose the pre-theoretical principle that most neurotypical, awake, adult humans are conscious – the same principle seems to be the justification for the hierarchical procedure of the INK strategy. If this is true and if we are pre-theoretically similarly certain that psychological duplicates are conscious as that humans are conscious, this supports the view that there should be a pre-theoretical principle saying that psychological duplicates are conscious.

Let us assume pre-theoretical principles entail that psychological duplicates are conscious. In the INK strategy, pre-theoretical principles are revisable in light of empirical and theoretical developments, they are not set in stone. So, psychological duplicates might, despite pre-theoretical principles, lack consciousness. However, pre-theoretical principles are taken to have at least minimal epistemic standing (Michel 2023) – there would need to be some overriding evidence or considerations to warrant giving them up. Yet, it is not clear what these considerations could consist in, given that we already know that all the behavioral and coarse-grained functional features of humans will be present in psychological duplicates. I find it equally hard to imagine evidence which disproves that psychological duplicates are conscious as to imagine evidence that disproves that humans (other than me) are conscious.

This point will become clearer in the next section when we aim to anticipate the results of scientific research on non-biological consciousness. Let us take stock. The anticipatory argument from folk psychology has some force. Humans can make Moorean arguments to the effect that psychological duplicates are conscious. How compelling they are depends on how compelling one takes arguments of this type to be generally. In addition, there are good reasons

for thinking pre-theoretical principles support attributions of consciousness to psychological duplicates. Yet, pre-theoretical principles can be revised, and the especially strong justificatory power of science does not derive from its pre-theoretical principles, but from the iterative, self-correcting process of evidence gathering, calibration of measures and theory-formation which bootstraps from the initial assumption of certain principles. Thus, to make a stronger case, we need to look at what science can tell us about AI consciousness. In due course, it will become clear that these arguments support each other: The anticipatory argument from folk psychology paves the way for a more compelling argument against biological views of consciousness.

4. The anticipatory argument from consciousness science

To a first approximation, the argument rests on the general idea that an ideal scientific process would, given the epistemic values implicit in science, attribute consciousness to some possible AI systems, and that we should make our beliefs conform to the outcomes of such an ideal scientific process. Here is the argument:

P1. The outcome of an ideal application of the INK strategy corresponds to facts about which creatures are conscious.

P2. If the outcome of an ideal application of the INK strategy corresponds to facts about which creatures are conscious, then there are (nomologically) possible (non-biological) AI systems which are conscious.

C. There are (nomologically) possible (non-biological) AI systems which are conscious.

P1 says the following: If an ideal use of the INK strategy converges on the result that p, then it is the case that p – at least with respect to the distribution of consciousness. What is an ideal application of the INK strategy? We have already outlined the INK strategy – roughly, treating consciousness as a natural kind to iteratively explain patterns and correlations of potentially consciousness-relevant features. An *ideal* application is a fictional application of the INK strategy where researchers have unlimited resources (including time), are perfect reasoners, and are immune to errors. So, we imagine researchers to do all relevant experiments, data analyses, and so on, while flawlessly constructing interpretations of these experiments and theories which skillfully explain these results. Then, they iterate by constructing improved measures, experiments, theories and so forth, until no further information or scientific insight can be gained that way. Given this idealization, the following conditional holds: If the INK strategy

can tell us which creatures are conscious, then the *ideal* INK strategy gives us the correct result (such that P1 holds).

Of course, in principle, someone could object that the INK strategy itself is flawed. However, as we have seen, the INK strategy is simply a high-level description of the process science generally employs to investigate putative natural kinds. It is unclear how else science could find determinate answers to questions about consciousness and comparative cognition (Boyle n.d.) than by asking whether members of the same natural kind are present across situations and creatures.[10]

If we take a scientific perspective on the question of AI consciousness, then we should adopt whatever view is the outcome of an ideal scientific investigation of this question. It does seem that we should take a scientific perspective to the question whether AI consciousness is possible. A reason is that it is unclear how metaphysics, or some other non-scientific domain of investigation, could settle this question. In general, the question what possible physical realizers of certain states are – i.e. whether consciousness can be realized in non-biological processes – appears like a scientific question. It lacks the degree of generality or fundamentality often associated with metaphysical issues.

If science can give us an answer to the question whether AI consciousness is possible and the appropriate scientific methodology is captured by the INK strategy, then P1 is true. The only alternative is to hold that nothing can give us an answer to the question whether consciousness requires biology. In this case, P1 is false and the anticipatory argument fails. So, I am assuming here that it can be found out in principle whether AI consciousness is possible.

However, even if questions about AI consciousness are metaphysically indeterminate or forever epistemically outside our reach, it might – even under this assumption – still be relevant what the outcome of an ideal application of the INK strategy consists in. It could be that this outcome would be similarly indeterminate. However, if it can be shown that an ideal application of the INK strategy delivers a determinate outcome, that must (under this assumption) be because non-epistemic considerations guide the process in a determinate direction. For instance, considerations of theoretical unification, simplicity, explanatory power, and predictive success (Bayne et al. 2024) might favor certain views about the distribution of consciousness, even if – by assumption – these values cannot be construed as truth-tracking in this case. Whether such values favor attributions of AI consciousness would still be pragmatically relevant, even if there is no fact of the matter about whether certain AI systems are conscious.

[10] Also, my argument is compatible with approaches to consciousness science beyond the INK strategy (see section 5).

So, P1 says that the outcome of the ideal application of the INK strategy matches what is true about the distribution of consciousness. P2 expresses that the outcome of the ideal application of the INK strategy will be that AI consciousness is possible. If both premises are true, then biological views are false.

Why believe P2? Again, we can focus on psychological duplicates as test cases of AI consciousness. Since we stipulated that psychological duplicates are silicon-based coarse-grained functional and behavioral equivalents to humans, we already have knowledge about the features of psychological duplicates that the INK strategy will discover. If consciousness is a natural kind, then an ideal application of the INK strategy will find rich clusters of cognitive capacities and patterns of cognitive and behavioral effects (Taylor et al. 2022) shared by humans, other animals (insofar as they are conscious), and psychological duplicates. These clusters will also manifest across phylogeny, ontogeny, and situations. Moreover, there will be shared computational mechanisms which explain these clusters.

At the same time, some biological properties which are part of this cluster of capacities, effects, and mechanisms in human and non-human animals are absent in psychological duplicates. This includes, for instance, the presence of a neocortex or a biological structure with a similar functional role (Stacho et al. 2020), or of certain global oscillations in the brain (Godfrey-Smith 2020). I hold that, in this case, an ideal application of the INK strategy would identify consciousness with the mechanisms underlying the shared, coarse-grained functional properties, rather than the fine-grained biological properties. The reason is that the theoretical virtues driving the INK strategy militate in favor of the former option.

First, positing consciousness as a coarse-grained functional kind which explains clusters of phenomena in biological and non-biological creatures provides *theoretical unification*. It posits the same kind of process – consciousness – to explain phenomena related to biological and non-biological creatures. By being unified, the resulting account is *simple*. It provides a single kind of explanation – consciousness – for clusters of cognitive effects and capacities in all biological and non-biological creatures. For this reason, the non-biological view also has a lot of *explanatory power*. Assuming non-biological consciousness licenses explanations of behavior across biological and non-biological creatures. For this reason, the non-biological view also gives consciousness *predictive power*: By positing consciousness, it can predict the appearance of a certain cluster of effects and capacities in biological and non-biological creatures alike.

Biological views are inferior with respect to these virtues. They cannot use consciousness to give a unified and simple explanation for shared clusters of capacities and

effects in biological and non-biological species. They have two options. First, they can posit two mechanisms: a biological one which explains the clusters of capacities and effects, including the biological ones, we find in biological creatures, plus a non-biological one which explains the same phenomena, excluding the biological ones, in non-biological creatures. The biological mechanism would then be identified with consciousness. However, positing two distinct mechanisms is obviously less unified, less simple, less explanatorily powerful, and less predictive than the non-biological explanation. There would be no explanation for why all coarse-grained functional and behavioral properties are shared between biological and non-biological creatures. Explaining this requires positing a shared mechanism, which can then be identified with consciousness.

Second, biological views could grant that there is a shared, coarse-grained functional mechanism which is causally responsible for these shared clusters in biological and non-biological creatures. However, they could argue that consciousness is distinct from this shared mechanism, and that consciousness depends on the specific properties that we only find in biological creatures.

However, this move is inconsistent with the INK strategy. According to the INK strategy, consciousness should be identified with whatever natural kind underlies and explains the clusters of phenomena that our different putative measures of consciousness target. When making this objection, proponents of biological views concede that all properties that humans and psychological duplicates share are explained via the same coarse-grained functional mechanism. These shared properties include all behavior as well as consciousness' effects on all cognitive capacities, including learning, reasoning, and attention.[11] So, most of the phenomena targeted by putative measures of consciousness are part of this cluster. Given this, the INK strategy is committed to identifying the natural kind which underlies this cluster with consciousness. Saying that consciousness is distinct from this natural kind contradicts the INK strategy and makes it questionable how consciousness can be scientifically studied in the first place.

Here are some further considerations which favor identifying consciousness with the coarse-grained functional kind, rather than the biological one. First, a theoretically elegant move for proponents of non-biological views is to hold that biology-based measures of consciousness (e.g. based on the presence of certain brain structures) are simply *not applicable* to non-biological creatures, rather than supporting the view that these creatures lack

[11] Potentially, one could individuate these capacities so finely that they are not shared by psychological duplicates, but – even then – the key explananda of consciousness science are ordinarily not individuated at that fineness of grain.

consciousness. Then, the absence of the biological properties these measures target does not need to be treated as speaking against attributions of consciousness to non-biological creatures.

This is plausible since the INK strategy generally requires us to realize that certain measures of consciousness are applicable in some populations, but not in others (Bayne et al. 2024). For example, verbal report cannot be used on (most) non-human animals. In addition, one can make a symmetry argument: If we – assuming that psychological duplicates are conscious – would devise measures of consciousness based on the physical realizer of psychological duplicates and then apply them to humans, the measures would give the result that humans are not conscious (since they are made out of other material). However, it seems more reasonable to say that the measure is simply inapplicable to humans, because it presupposes that its target is made from silicon. However, if so, by the same principle, it is plausible to say that biology-based measures are simply inapplicable to psychological duplicates, since these measures presuppose that their targets are biological creatures.

Second, as indicated earlier, pre-theoretical principles support attributing consciousness to psychological duplicates which in turn requires identifying consciousness with the coarse-grained functional kind. Relatedly, it is not only the case that the cluster explained by a coarse-grained functional kind explains most of the phenomena targeted by putative measures of consciousness. In addition, these are phenomena – like verbal report and visual discrimination – which are particularly central to our pre-theoretical conception of consciousness. Pre-theoretically, we characterize consciousness as the kind which explains central phenomena like verbal report and visual discrimination, not necessarily certain biological traits. Since this pre-theoretical conception is the initial starting point for consciousness science, it should be – to some extent – reflected in the natural kind consciousness science eventually converges on.

Third, I have argued in section 3 that most people would find it self-evident that psychological duplicates are conscious. So, scientific accounts which identify consciousness with a coarse-grained functional kind conform better to the deep convictions of the society which embeds this science. This is the most speculative argument I will make, but this consideration may be relevant if and because science ought to be receptive to societal demands (e.g. Douglas 2009). A science which depicts psychological duplicates as not conscious would contradict what laypeople take to be an obvious assumption, for example when thinking about how to interact with non-biological creatures. Therefore, scientific results could arguably not

fruitfully inform societal decision-making since they would not be acceptable to the concerns and deep convictions of laypeople.[12]

To recap, I have argued that the outcome of an ideal application of the INK strategy is that it is nomologically possible for AI systems (made out of conventional materials) to be conscious. The reason is that this view possesses theoretical virtues, in addition to fit with pre-theoretical principles and deeply held convictions of wider society, which make it preferrable to biological views, given the INK strategy. Moreover, since we should take a scientific perspective to the question whether consciousness requires biology and the INK strategy is the best way to implement a scientific investigation of this question, the outcome of an ideal application of the INK strategy corresponds to the facts of the matter. Thus, non-biological AI consciousness is possible.

The most controversial background assumption of the previous argument is that psychological duplicates are (nomologically) possible. If one is skeptical of this view, then the conclusion of this argument should be taken as a conditional: If psychological duplicates are possible, then – since these creatures are conscious – (non-biological) AI consciousness is possible.

5. Generalizing beyond the INK strategy

I will argue now that the conclusion of my argument does not depend on the INK strategy, since other accounts of how to study non-human consciousness allow for equally strong arguments against biological views. It seems to me that there are two main alternatives to the INK strategy in the literature:

1. Propose self-standing behavioral indicators, without an iterative search for natural kinds.

For example, Tye (2017) argues that types of behaviors which are caused by conscious experience in humans provide (defeasible) evidence of consciousness, when they occur in other animals species. Since psychological duplicates are behaviorally equivalent to humans, it is clear that we would attribute consciousness to some possible non-biological AI systems, if we think behavioral measures are decisive. If we think behavioral measures are only heuristically useful and must eventually be superseded by more reliable types of measures, then we need an independent account (like the INK strategy) which tells us what these further measures consist in and how they should be calibrated.

[12] By analogy, suppose science would purport to show that 50% of ordinary humans are not conscious. It is not clear how we could meaningfully make use of that information in societal decision-making.

2. Make assessments of consciousness based on comprehensive theories of consciousness (Carruthers 2020; Doerig et al. 2021; Seth and Bayne 2022).

My argument generalizes to such *theory-based strategies* in consciousness science. It has often been noted that theories of consciousness are underspecified, having the consequence that they can be applied in multiple and conflicting ways to non-human systems (Butlin et al. 2023; de Weerd 2024; Dung 2022; Michel 2019; Shevlin 2021). Moreover, they arguably *should* initially be under-specified in this way. The choice whether a theory of consciousness should be specified further such that it allows for non-biological consciousness or not should be made in an evidence-based manner, not by stipulation (see Shevlin 2021).[13] We need independent evidence to tell us whether a theory of consciousness should be interpreted as attributing consciousness to AI systems.

For example, the perceptual reality monitoring theory (PRMT) (Lau 2022; Michel forthcoming) claims that consciousness involves monitoring the reliability of one's own sensory signals. According to the theory, a PRM mechanism in the brain produces pointer representations which encode information about how reliably neuronal signals represent the world as it is right now. Then, a neuronal representation of a feature is taken to be conscious in virtue of being flagged as reliable by a (meta-representational) pointer produced by a PRM mechanism.

As it happens, proponents of PRMT are sympathetic to an interpretation according to which the theory is compatible with non-biological consciousness (Butlin et al. 2023, section 2.3; Michel and Lau n.d.). However, the empirical evidence for the theory is mostly based on brain imaging studies in humans. This evidence cannot distinguish between the hypothesis that consciousness requires biology and that it does not: after all, all humans are biological creatures. So, to examine whether PRMT should be interpreted such that it supports AI consciousness or not, one would need to draw on a wider range of evidence from a wider range of creatures, including non-biological creatures.

For this reason, a theory-based strategy – if it wants to be informed by relevant evidence – would need to draw on the same kinds of factors when assessing which artificial systems to attribute consciousness to (if any) as the INK strategy: a) a range of consciousness-related measures that have been calibrated in biological creatures (especially humans), including behavioral criteria, b) clusters between these measures, c) considerations of theoretical virtues,

[13] My argument does not generalize to theories of consciousness which are supposed to derive their justification independently from empirical evidence, such as integrated-information theory (Bayne 2018; Tononi and Koch 2015) or panpsychism (Goff 2017). Taking such a theory as a basis corresponds to a metaphysically driven investigation of non-human consciousness, as opposed to the science-based methodology my argument rests on.

d) pre-theoretical principles, and e) fit with the deep convictions of larger society. Since the sources of considerations for assessing biological views would be the same as on the INK strategy, a theory-based approach to consciousness science would reach the same verdict: A coarse-grained functional interpretation of PRMT (or any other theory) is supported by theoretical virtues, pre-theoretical-principles, and fit with the beliefs of the surrounding society. Thus, an ideal theory-based investigation also reaches the verdict that AI systems can be conscious.

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