

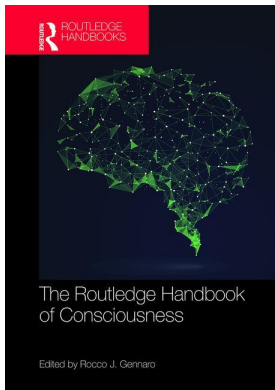
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ANIMAL CONSCIOUSNESS

Sean Allen-Hermanson

1 Introduction

Animal consciousness continues to draw the attention of philosophers, scientists and general audiences and is tethered to ongoing debates about fundamental questions of mind, knowledge, and morality. Phenomenal consciousness is very hard to define without reference to itself, and perhaps the best one can say is something along the lines of “states of mind with a qualitative feel” (Nagel 1974). Knowing which animals are sentient and knowing what it is like, that is, what kind of consciousness they possess, are respectively known as the Distribution and Phenomenological questions (Allen 1998) and essentially aspects of the problem of other minds extended to nonhumans (Allen and Trestman 1995/2016). Indeed, our ignorance about other species is arguably the quintessential formulation (Harnad 2016). Knowing anything about phenomenal feel is especially difficult, with the exception of when it is like nothing (Akins 1993) or for qualitative experiences regarding which we have first-hand acquaintance (Allen-Hermanson 2017), though see Thompson (1992), Thompson et al. (1992) and Matthen (1999) for reflections on alien perceptual qualities in nonhumans, especially colors. As much more has been written on the problem of distribution, this chapter will focus on providing an overview of the main philosophical responses to curiosity about which animals are conscious.

2 Basic Issues

Among the foundational matters not to be discussed here include whether consciousness is physical or non-physical, whether it is epiphenomenal, whether “punctate” minds are possible (made up of independent “atoms” of experience) or if clusters of conscious states must be bundled as a unified subject, whether it occurs on a gradient (like baldness, which comes in degrees) or is “binary” (like pregnancy, it’s either there or it’s not), whether there is an explanatory gap, whether consciousness is an irreducibly fundamental aspect of reality, its flow and relationship to time, and the nature of the relation between consciousness and intentionality, if any. These problems exacerbate the difficulty, perhaps intractably, of puzzlement about what it is and how it is distributed. Complicating matters further is the diversity of cognitive mechanisms, behaviors, and organisms to be considered, making it difficult to apply any single, all-encompassing

treatment; “fish” is actually a vastly heterogeneous category, for instance (Allen 2013). But most basic is the matter of how the subject should be approached philosophically. Should we first sort out a “metaphysical” theory, which could then be applied to specific cases including various nonhuman species? Alternatively, perhaps we can table inquiry into what it is and proceed with our epistemological investigations (Allen and Bekoff 1997). Both types of approaches are taken up by scholars and researchers with examples of each to be canvassed next.

3 Epistemology First?

Though the mental lives of other people are not normally in serious doubt, we are often unsure if another thinks or feels as we do. There are also various uncertain cases, such as people in vegetative states, fetuses, and anencephalic infants. The status of animal consciousness is not just a philosophical problem either, and the difficulties concerning those incapable of speech are compounded by differences in anatomy and behavior. Overcoming the epistemic problems requires that we avoid both anthropomorphism (like Scylla, multifaceted and resilient) and excessive skepticism (like Charybdis, obliterating), though there are no generally accepted methods or principles for navigating these twin perils (see Fisher 1996 and Kennedy 1992 for contrast). Morgan’s “Canon,” for instance, was one reaction to overly generous anecdotes:

[I]n no case may we interpret an action as the [outcome of the exercise of a higher psychical faculty, if it can be interpreted as the outcome of the exercise of one which stands lower in the psychological scale.

(Morgan 1894: 53)

The Canon was widely acknowledged as the scientific study of animal cognition began to develop in the beginning of the 20th century, particularly among behaviorists. In recent years it is mainly a historical curiosity, though there is a lively academic discussion about its proper interpretation, such as whether it is just a form of parsimony, or perhaps Ockham’s razor (Burghardt 1985; Sober 1998; Allen-Hermanson, 2005; Sober 2005; Sober 2009; Fitzpatrick 2008).

Block (2002) argues that since the human case is the starting point for our investigations, it is unclear how we can have any grounds for attributing consciousness to beings physically and neurologically very different from ourselves, even if they are “common-sense functional isomorphs” acting as if they have experiences in virtue of internal states satisfying the causal roles making up our mental lives. There is, as Block puts it in earlier work, a “prima facie doubt” (1978). Indeed we cannot even form a conception of what those grounds could be in what he calls the “harder problem” of consciousness. Therein lies a tension between reconciling scientific understanding with the fact of subjective awareness: “these commitments do not fit together comfortably.” If Block is correct then the hope that we may somehow merge first-person accounts and scientific approaches (Burghardt 1985) in order to “obtain testable hypotheses about private experience” (Burghardt 1997; Burghardt and Bekoff 2009) teeters on incoherence, despite an influential legacy (Morgan 1894; Griffin 1976, 1978, 2001). Block is trading on intuitions that may not be shared, though the stakes are high: his view suggests the study of animal consciousness cannot proceed with any confidence absent close scrutiny of neurological similarity and difference.

Leaving these preliminary matters aside, there are three main epistemic strategies available: Analogical (similarity) arguments, Inference to the best explanation, and Perceptualism.

4 Other Animal Minds: Historical Context

The use of comparative reasoning to ground our knowledge of other minds is often attributed to Mill (1889: 244) though its pedigree is much older, probably ancient.

Awareness of the problem of other minds may or may not be motivating Descartes' example about "hats and cloaks" in the second Meditation (1641a/1985)—though it is raised by Augustine, who is known to have influenced him, and where we also find one of the earliest expressions of the analogical solution (Matthews 1986). Although Matthews believes the problem "is not raised explicitly anywhere in Descartes" (1986: 144), we come close enough in his correspondence (see also *Discourse on the Method* Pt.V 1637a/1985). In a letter to the Marquess of Newcastle, Descartes writes "In fact, none of our external actions can show anyone who examines them that our body is not just a self-moving machine but contains a soul with thoughts..." with, of course, the exception of "words, or other signs" (1646/1991: 303). Descartes notoriously denies all aspects of mind to animals here and elsewhere.

Writing to More, Descartes argues we can have no absolute certainty on the matter of animal minds either way since "the human mind does not reach into their hearts" (1649/1991: 365). Despite this, many conform to the "preconceived opinion...accustomed from our earliest years...that dumb animals think" (ibid.). This popular view depends on "very obvious" analogical reasoning, in that "many of the organs of animals are not very different from ours...they have...sense-organs like ours, it seems likely that they have sensation like us...but there are other arguments...not so obvious...which strongly urge the opposite" (1649/1991: 265–6). Crucially, for Descartes "thought is included in our mode of sensation" (1649/1991: 365) by which is meant that phenomenal consciousness is part of rational judgment and a linguistic mode of representation (some, e.g., Cottingham 1978: 555, dispute this reading, though not convincingly).

Descartes' viewpoint is situated within his interactionist dualism, whereby human behavior cannot be explained unless we invoke both mechanism and mental substance (*res cogitans*). However, in the case of animal behavior the "mechanical and corporeal" (1649/1991: 365) is sufficient. Descartes thinks the everyday comparisons are revealed as superficial by way of three arguments: many animals move like machines (think of the haphazard flight of a butterfly); there are probably natural automatons ("art copies nature" 1649/1991: 366); and although animals are without language, "speech is the only certain sign of thought" (ibid.). In the *Discourse on the Method* Descartes emphasizes the creative aspect of language, noting an animal could never "produce different arrangements of words so as to give an appropriately meaningful answer to whatever is said in its presence" nor can they use what they know to respond flexibly in "all kinds of situations" as competent human beings can (1637a/1985: 140).

Although "*thinking* is to be identified...also with sensory awareness" (1644/1985: 195) Descartes' occasional reference to animal "sensations" (1649/1991: 365) such as "anger, fear, hunger, and so on" (1649/1991: 366; 1646/1991: 303) is sometimes taken to imply that he did in fact believe animals were phenomenally consciousness (Andrews 2015: 54). Yet it is hard to accept this was his considered view, since he often denied animals to have an incorporeal soul (1637b/1991: 62, 1641b/1991: 181, 1646/1991: 304, 1649/1991: 365; Cottingham 1978: 557). While it has been suggested that these remarks are better regarded as some kind of lapse (Cottingham 1978: 558), a more charitable reading, faithful to his texts, is that by "sensation" (sometimes "organic sensation" Seager 1999/2016: 4) Descartes only means certain movements of the body machine transmitted to the brain would have given rise to conscious episodes in the presence of *res cogitans*, so e.g., "hunger" in an animal is nothing more than internal muscle contractions and "brain commotions" (as mooted, though ultimately rejected by Cottingham 1978: 558). This would go some way towards making sense of his acquiescence in

the dismemberment of living animals (such as dogs) for scientific and medical advancement. As he writes in a letter to Mersenne, “I do not explain the feeling of pain without reference to the soul” and so animals lack “pain in the strict sense” (1640/1991: 148).

Some have disputed that Descartes was a brute to the brutes in his actions. Dennett (1995: 692), via Leiber (1988), dismisses the “myth” Descartes was a “callous vivisector, completely indifferent to animal suffering...” To the contrary, Dennett portrays Descartes as “first victim” of a “lunatic fringe,” continuing in the accusations of Mary Midgely and Peter Singer, against those innocently seeking to discover “how animals actually work!” Certainly, Leiber airs some second thoughts about the reliability of reports from Descartes’ contemporaries. Yet concerning insensitivity to ill treatment he switches focus onto the fabulous, Disneyesque characterizations of animals’ inner lives offered by Descartes’ ideological opponents (Leiber 1988: 312ff.). But this is just irrelevant to the matter at hand, as is Leiber’s rationalization of Descartes’ vivisection of a rabbit (described in a letter to Plempius 1638/1991) as nothing other than “a most serious and painstaking pursuit of the truth” (Leiber 1988: 315). Could the tormented rabbit, chest opened, ribs removed, aorta pinched, also be said to have had a stake in the taking (and giving) of pains? In his defense, Descartes was probably no worse than many of us complicit in the infliction of suffering for a good cause, and unlike most beneficiaries of modern medicines, factory farming, and consumer products, his callousness is mitigated by the reasoning that animal behavior is dissimilar to movement under conscious direction.

This also demonstrates how the analogical strategy can backfire. In his letter to the Marquess of Newcastle, Descartes observes that animals can only “imitate or surpass us in those of our actions which are not guided by our thoughts, “such as when we “walk or eat without thinking” (1646/1991: 302). Certainly his skepticism has not been embraced, and indeed powerful arguments and evidence testify to quite sophisticated cognizing in many non-humans. Nevertheless, Descartes’ dissatisfaction with the analogical solution to the problem of other animal minds finds many fellow travelers with philosophers and scientists continuing to debate the place of similarity-based reasoning, and his insight about adaptive response continues to be hugely influential.

5 Analogical Arguments

[W]hen a living body is moved there is no way open to our eyes to see the mind... But we perceive something present in that mass such as is present in us to move our mass in a similar way; it is life and a soul....Therefore we know the mind of anyone at all from our own.

(Augustine in Matthews 1986: 144)

At least since Augustine, the analogical solution to the problem of other minds finds expression in the writings of such notable philosophers as Locke (1689/1975 bk. IV, ch. iii, par. 27), Hume (1739/1978 bk. I, pt. III, sec. xvi), Mill (1889), James (1912/1971), Broad (1925), Russell (1948) and Ayer (1956). Hume’s (1739/1978) comparative reasoning about behavior led him to conclude that animals think, reason, and form associations between their sense impressions, though not with the same degree of sophistication as human beings. Others in their wake continue to employ analogical reasoning about animals (e.g., Singer 1975/1990, 1993; Perrett 1997).

“Behavior” is now understood widely to include physiological response (such as cardiac acceleration as an indicator of anticipation, or sensitivity to opioids for feelings of pain) as well as modulatory effects of cognitive states, such as emotions on learning and memory. Perceptual behavior includes reactions to ambiguous stimuli and awareness of threats. Metacognitive monitoring is investigated by way of perception (Smith et al. 1995), memory (Hampton 2001) and

foraging (Call and Carpenter 2001), though interpretations positing high level awareness and control need to be carefully scrutinized against deflationary accounts (Hampton 2009).

The relative importance of the different bases for analogizing is a matter of debate, with some urging that “physiological data can play a qualitatively different and more definitive role” (Farah 2008) while others equally draw on “molar” behavior, in the sense of actions falling under everyday platitudes (e.g., Varner 2012, though not without other considerations mixed in). Besides behavior, two other important sources of human–animal continuity are neurocognitive mechanism and common evolutionary descent.

The structure of the argument from analogy for animal consciousness turns on the premise that conscious human beings are highly similar to most individuals of this-or-that species. Since this draws on features of large groups, this formulation avoids the “single case” problem for the analogical solution to the problem of other (human) minds, namely that reasoning on the basis of one, possibly unique case (i.e., my own), to a general conclusion about others makes for a weak induction (Malcolm 1962; Andrews 2008/2016). Then again, for the analogy about animals to get started we need to already know other human beings are conscious. If we don’t need analogy to know that, why do we when it comes to animals?

A second problem area is that, unlike other inductions, e.g., the color of swans, the conclusion cannot be independently confirmed (Ryle 1949: 15; Pargetter 1984), though others dispute whether this matters. Hyslop and Jackson (1972) counter that since an induction that can be verified by other means can also be disconfirmed by other means, the fact that it can be checked adds nothing to the cogency of the inference (see also Plantinga 1967). Another limitation is that the analogical strategy runs the risk of chauvinism for sentients highly dissimilar to human beings (Graham, 1993/1998) raising the possibility of uncheckable type-2 errors (i.e., false negatives).

A third criticism concerns the difficulty in knowing which properties should factor into the comparison (Pargetter 1984). Returning to a theme from Descartes, animals resemble human beings only to a degree and it is hard to know when (and what) accumulated differences ought to defeat judgments about sentience (Allen 2004: 622). Instead of a comprehensive tally of all shared characteristics, only certain relevant properties—behavioral, physiological, neural or evolutionary—should be considered. Yet if we knew which ones counted there would be no problem of other minds! Even if the analogical solution does not depend on a full-blown theory of consciousness, knowledge of some crucial marks of structure and function do seem to be needed (Allen and Trestman 1995/2016). Others have argued for a hybrid account in which reasoning about competing hypothetical inferences is incorporated (Melnyk 1994).

6 Inference to the Best Explanation

Where the Argument by Analogy sought to extend what is given in introspection to other individuals, Inference to the Best Explanation (IBE) doesn’t depend on self-observation. This is because posits in a successful empirical theory don’t have to be directly observed: genes, the planet Neptune, electrons, and dinosaurs are all strongly evidenced, though only indirectly by way of their observable effects. Arguably “mentalism,” or the positing of beliefs and desires (and perhaps states of consciousness) that are real internal causes of behavior can be the *best* explanation (Pargetter 1984).

Best explanation-style reasoning is often offered as a solution to epistemic doubts about animal minds (Bennett 1991; DeGrazia 1996; Allen and Bekoff 1997; Lurz 2009a: 7; Bermúdez 2003; Heyes 2008). Improvised paths are but one source of evidence for internal mental representations in animals, perhaps suggestive of “cognitive maps” (Tolman 1948; Gallistel 1990;

Gallistel and King 2009). Observations favor mentalism over skepticism (and behaviorism) when a test is passed that other hypotheses fail. The attempt to show animals make logical inferences by ruling out deflationary alternatives, such as the use of smell or other perceptual cuing (Call 2004) is another example (e.g., see Sober 2000, 2005, 2012, 2015 for a detailed examination of related considerations, including evolutionary propinquity and parsimony).

IBE has several virtues such as its anti-chauvinism, since a being need not be similar to me or even have a human form for the attribution of internal states with psychological roles to have the greatest, most unifying, explanatory power. It also doesn't depend on induction from a single case, and it accounts for the fuzzy persuasiveness of analogical reasoning in that my behavior and the behavior of beings similar to me are explained in a similar manner (i.e., in terms of beliefs and desires). Having said that, IBE isn't well understood as it is unclear what kinds of characteristics make an explanation best (Plantinga 1967; Lipton 1991), though simplicity, generality and coherence with the rest of our knowledge have been suggested (Harman 1965; Thagard 1978). As with other scientific theories, attributions of mind must be eligible for revision or perhaps complete overthrow (with respect to animals, behavioristic explanations typically threaten, e.g., Kennedy 1992; Wynne 2004). Another complication is that there may not be a clear demarcation between deflationary and non-deflationary hypotheses, such as associationist versus cognitivist (Penn and Povinelli 2007; see also Rescorla 2009; Allen and Bekoff 1997: 57–8; Buckner 2011; Mitchell et al. 2009).

Inferring the presence of mental states by their causal roles has also been applied to the problem of animal consciousness (Lurz 2002; Dretske 1995; Tye 1997, 2016), though this requires a grasp of its function (assuming it has one!). Unusual types of sensation (e.g., electroreception) may also lead to doubts: if we don't know what it is like, why assume it is like anything? The answer is that conscious feeling might still have objectively accessible causes and effects notwithstanding further facts about irreducibly qualitative character. As with mental state types in general, determining functions or causal roles might need to draw on everyday intuition, scientific investigations, or perhaps both. What relationship is there between propositional attitudes and attributions of phenomenal consciousness (Lurz 2009b)?

Perhaps consciousness best explains adjustment for perceptual error and can be evidenced by contrasting perception and belief (Allen and Bekoff 1997: 152). Although a fly can be “fooled” by the Müller-Lyer illusion (Geiger and Poggio 1975), there can be no mismatch between how things look versus what it takes to be true. Carruthers (2000) similarly proposes consciousness is a capacity for making an appearance–reality distinction. Various somewhat overlapping proposals about the cognitive role for consciousness include adaptive control (James 1912/1971; Block 1995; Dretske 1995), practical judgment (Kirk 1994), guidance by inner maps (Tye 1995), a central representation used to situate and move the body (Merker 2005, 2007), and higher-order awareness (Lycan 1987; Rosenthal 1986), perhaps in the form of self-report (Dennett 1991).

Cognitive interpretations of consciousness emphasize integrated use of sensory representations in control and movement, perhaps in the sense of being guided by reasons (Dretske 2006). When it comes to clarifying the functions of phenomenal consciousness on behalf of the epistemic strategy—whether it be in terms of higher order thinking, pain behavior, sensory integration, rational action, or what have you—trafficking in the metaphysical approach may be unavoidable. A lingering worry is that unlike beliefs and desires, awareness of states of consciousness in others is not strictly like a scientific inference. Qualitative features of mental representations may offer no added value to explanations of animal behavior (Carruthers 2005b: 203). It may be necessary to draw on one's direct acquaintance with phenomenal properties of experience, hence revisiting difficulties with the analogical solution to the other mind's problem (Melnyk 1994).

7 A Non-Inferential Solution?

In a third school of thought our knowledge of other minds is a matter of direct perception, much as when we make sensory judgments about everyday objects. Sometimes drawing on the phenomenology of Husserl (1913/1982) and Merleau-Ponty (1962), but also defended by disciples of Wittgenstein, behaviorists, and others (e.g., McDowell 1982), mentalistic attribution is not based on inference or theoretical judgment, so e.g., we don't infer pain from behavior, rather we just see it in the expression of wincing, moaning, etc. However, Perceptualism and its application to the problem of other animal minds (Cockburn 1994; Dupré 1996; Jamieson 1998; Cassam 2007) must meet several challenges.

How can we be sure inferences are not being made which are fast and unconscious? One reason for thinking this might be the case is because the direct perception of mental states would have trouble accounting for error. The Perceptualist can respond that these judgments depend on background knowledge helping to set default assumptions—such as that Martian marionettes (Peacocke 1998) and Blockheads (Block 1981) are highly atypical. But what background conditions ought to be assumed about fish, insects, and so on? How, that is, do we know what to frame as error given that we aren't sure which of our mentalistic attributions towards animals are correct? Relatedly, how do we adjudicate disagreement and balance skepticism against anthropomorphic bias? Indeed, why should there be so much variance in our views on animal minds (compare how there is little disagreement about whether there is a tree or a rock in the vicinity)? And what form does this perceptual access take? We can't literally see states of mind, though one could try to draw an analogy to our indirect awareness of the hidden surfaces of physical objects (Husserl 1913/1982; Smith 2010). In scene segmentation, for example, an object is perceived as a unity despite some of its parts being out of view: consider a housecat partially hidden by a blanket leaving only its head and tail in sight. For the Perceptualist the judgment about the cat at least seems automatic and immediate rather than the product of deliberate reasoning. On the other hand, this comparison is strained by the fact that mental states are not open to direct examination from other angles and perspectives. In light of the various difficulties, perhaps the role of inference in mental state attribution needs to be conceded after all, with some recommending a hybrid account (Roelofs 2017).

8 Metaphysics First?

Alternatively, perhaps we should work out a theory of consciousness before returning to the epistemic questions. One drawback with this approach is the heterogeneity of the philosophical menu, with widely divergent implications for animal subjectivity. In addition, it is unclear whether pre-theoretical (folk) judgments about animal minds ought to constrain our choice of theory. It is sometimes, for example, taken as a *reductio* of a theory of consciousness that it implies most animals are not phenomenally aware (e.g., Allen and Trestman 1995/2016; Gennaro 2009: 184; Tye 2016: 21). Or should one reject those folk judgments if they do not cohere with an account deemed plausible on other grounds (Lycan 1999)? As many leading theories can be loosely categorized as falling within the hardware/software distinction, this survey will examine ones that can be broadly characterized as either Neural-reductive or Functionalist.

9 Neuroreductive Approaches

Sidestepping some philosophical conundrums, Crick and Clark (1994) proposed researchers focus on the direct examination of neural mechanisms minimally sufficient for phenomenal

awareness, as this can at least enlighten as regards the Neural Correlate of Consciousness (NCC). In outline, the strategy is simply to determine how brain processes differ between when subjects are aware as opposed to unaware of a stimulus. In application, extensive work has been done with brain imaging and psychophysics to investigate mechanisms and behavior, especially in vision, sleep, anesthesia, and neuropathology. The next step is also, in a sense, elementary though difficult to establish for empirical and conceptual reasons: one employs similarity-based reasoning to argue this-or-that species either has or does not have structures homologous to (that is, having a shared ancestry with) the human NCC. The chief dividend paid so far finds neocortex sufficient, especially thalamocortical regions working in conjunction with subcortical structures (Laureys et al. 2004; Laureys et al. 2009/2013). Mammalian hardware stands out as highly similar to the human case, though we cannot be sure what significance attaches to its absence in light of the possibility of human-centric chauvinism.

Though probably most neuroscientists believe consciousness depends on a functioning neocortex, some claim subcortical structures, such as the midbrain, suffice. The difference it makes is that consciousness would turn out to be much more widely distributed. Support for the midbrain view often draws on observations of children afflicted with congenital hydranencephaly (i.e., those born decorticate) who nevertheless evidenced strong signs of conscious awareness (Shewmon et al. 1999; Merker 2007, 2008; Aleman and Merker 2014). Some take this to mean consciousness could also be present in animals lacking a neocortex but having structures reminiscent of the midbrain (Merker 2007), such as many fish (Tye 2016: 84). Transferring these results to nonhumans (Barron and Klein 2016; Woodruff 2017) illustrates the dictum that “extrapolations require cautiousness” (Le Neindre et al. 2017) however.

Notably, the individuals in question weren't true hydranencephalics (Shewmon et al. 1999: 371). It appears that the brain was already investing in cortical resources and reassigned midbrain cell populations when problems arose. In mammals neurons are generated from generic progenitor (stem) cells (Gage 2000; Ming and Song 2005) and are known to pass through a critical period for plasticity (about 1–1.5 months, Ge et al. 2007) for adaptation to various subtypes (Molyneux et al. 2007). This means early stage midbrain neurons could be reprogrammed to function differently. The identity of these cells and higher level structures could be verified by their “preferred” stimuli and other organizational features characteristic of auditory cortex (Schreiner et al. 2000; Kandel et al. 2013: 700)—in theory, that is, since the children in question died, no autopsies were performed, and the brain scans administered were imprecise. In short, cortical functioning isn't shown to be unimportant just because it has taken up residency at an unusual address.

No doubt, neocortex will continue to take a central place in debates over the identity of the NCC.

10 Representationalism

The leading “software” approaches are known as “Representationalist” theories reducing phenomenal consciousness to mental representations or intentional states of some sort. According to First-Order Representationalists (Kirk 1994; Dretske 1995; Tye 1995, 2000) conscious representations play a certain sort of cognitive role (especially being poised to make a difference to belief and action) emphasizing input integration and output flexibility typically along the lines of such views as Baars' Global Workspace (1988, 1997, 2005a) and Block's (1995) “access” consciousness. These ideas have been explicitly applied to the problem of sentience in nonhumans (Edelman and Seth 2009), such as birds and cephalopods (Edelman et al. 2005).

An important feature of the First Order Representationalist theory (FOR) is that it more or less straightforwardly implies many animals are conscious insofar as there is a sophisticated cognitive economy going beyond tropism and rudimentary learning. Whether this should be regarded as a feature or a bug is a matter of debate (Allen and Trestman 1995/2016). Tye (2000, 2016) finds that FOR most strongly suggests consciousness in mammals and birds, with a weaker though still reasonable case for teleost (bony) fish, reptiles, cephalopods (octopuses, squids and cuttlefish) and even one insect genus (*Apis*, i.e. honeybees)—though sharks, rays, most insects, and many “lower” vertebrates do not measure up.

Besides over-generosity, FOR has been criticized for having difficulty giving an account of conscious awareness of belief and desire (Lurz 2006), though the main reason some philosophers have sought an alternative formulation of Representationalism owes to the assumption that conscious mental states are simply ones the subject is aware of, hence requiring a higher-order awareness (Lycan 2001). Appeals to purported examples of unconscious perceptions, such as distracted driving (Armstrong 1968) and blindsight (Carruthers 1989; 1996), motivate similar objections, though it is not obvious to this author that there is nothing that it is like for the inattentive driver or that the requisite integration and flexibility demanded by FOR is present in those kinds of cases (Seager 1999/2016). A major worry on the horizon for First Order Representationalists ought to be robots and autonomous vehicles, which put pressure on the threshold for attributing attitude-like states of information processing. The F-16 drone that can “figure out” the safest path to a ground strike and respond to threats if interrupted (Lockie 2017) is not conscious, though as art continues to copy nature, sooner than later human contrivances guided by information states provided by “accredited receptor systems” (Dretske 2006) will exacerbate the metaphysical (and moral) dilemmas.

The other major version of Representationalism casts consciousness in terms of the mind’s awareness of itself perhaps starting with Locke’s proposal that “reflection” serves as inwardly oriented perception (1689/1975). It is uncertain whether Locke intended to equate reflection and consciousness (Thiel 2011), but as reflection consists in acts of inner observation, or “second-order” representing, his view has come to be associated with Higher Order Perception (HOP) or “inner sense” theories of consciousness as developed by Armstrong (1968, 1981), Lycan (1987, 1996) and others. On the assumption that perceptual higher-order awareness does not require any thoughts, the application of mentalistic concepts, or grasp of folk-psychology, the inner sense view is perhaps no less friendly to widespread consciousness in animals than First Order Representationalism. It remains unclear what this awareness consists in, however. In light of the transparency or “diaphanous” aspect of introspection (Moore 1903) some claim it has no distinctive phenomenology (Dretske 1995; Güzeldere 1995), and even if it does, which animals satisfy is not known (Lycan 1999).

HO theories are united in holding that what makes a mental state conscious is that it is taken as the representational object of a second (or higher) order mental state, though some philosophers argue these ought to be understood as thoughts rather than sensory perceptions (e.g., Rosenthal 1997 and Carruthers 2000 who differ over whether the HOT’s need to be actual or merely dispositional states of the cognitive system). A close alternative view eschews the requirement of an additional state, replacing this with the idea that one and the same representation must be directed at some aspect of world while also being reflexively directed at itself (Kriegel 2009; Gennaro 2012).

A standard objection to the HOT theory is that most animals and even human infants don’t possess the requisite concepts for tokening thoughts about mental representations (Dretske 1995; Kim 1996; Seager 2004; Bermúdez 2003, 2009; Proust 2009), with very few exceptions, possibly chimpanzees (Andrews 2012; Lurz 2009b, 2011; Tomasello and Call 2006; Call and

Tomasello 2008). However, even concerning chimps there is “very little consensus” (Fitzpatrick 2009: 258). Other, more dubious, candidates include “perspective taking” in corvids (such as ravens [Bugnyar and Heinrich 2005] and scrubjays [Dally et al. 2006]), “deceptive behavior” in squirrels (Steele et al. 2008), and “empathetic behavior” in rats (Bartal et al. 2011).

Some HOT theorists accept the denial of consciousness to nonhumans (Carruthers 1989, 2000, 2005a) or at least face the possibility with equanimity (Lycan, 1999). Others, such as Gennaro reject the claim that higher-order thoughts require robust first-personal concepts or language (1996, 2004a, 2009) with Lurz (1999) and Van Gulick (2006) similarly arguing that less sophisticated concepts (such as “looking” and “seeing”) can be attributed to animals and suffice for tokening HOTs. This suggestion is also controversial (Carruthers 2000, 2005b) and discussion is ongoing (Gennaro 2004b, 2009; DeGrazia 2009).

11 A Critique of the Cambridge Declaration on Consciousness

In 2012 neuroscientists gathered to support “unequivocally” (Low et al. 2012: 1) a statement synthesizing main points of agreement, particularly that “humans are not unique in possessing the neurological substrates that generate consciousness,” as these are possessed by “all mammals and birds, and many other creatures, including octopuses” (Low et al. 2012: 2). Little specific evidence is discussed in the supporting rationale though it mentions cortical activity in conjunction with subcortical regions in humans, adding that conscious states, such as emotions, “do not appear to be confined to cortical structures” (Low et al. 2012: 1). The preamble is unclear on whether subcortical regions must work in tandem with cortical activity, or, on their own, absent cortex, suffice for phenomenal awareness.

The Declaration itself vacillates between the highly plausible claim (with apologies to Descartes and certain HOT theorists) that consciousness is not unique to human beings with the more controversial idea that it can be extended far beyond mammals and birds to invertebrates, especially octopuses, and perhaps insects (the latter are only specified in the preamble). The Declaration begins: “The absence of a neocortex does not appear to preclude an organism from experiencing affective states. Convergent evidence indicates that non-human animals...have...conscious states...” (Low et al. 2012: 1). But since neocortex is a mammalian characteristic, the logical continuation ought to have been “non-mammals,” not the broader category “non-human animals.” Rhetorically, the understatement makes the Declaration seem less divisive than it is.

A second weakness concerns the awkward fit of octopuses and other invertebrates since it is doubtful they possess structures homologous to even mammalian subcortices, let alone neocortex—though birds are in a better position on both counts (see Karten 1997; Jarvis et al. 2005; Calabrese and Wolley 2015). The Declaration mentions attention, sleep and “decision making” (Low et al. 2012: 1) in insects and cephalopods, but this does not make a persuasive case for consciousness. One is left to wonder whether behavioral evidence (such as adaptive problem solving) is convincing on its own. After all, we knew other people were conscious long before we knew anything about brains, or is the case for consciousness in the octopus less strong than the Declaration would have us believe?

12 Animal Pain

Animal welfare is a major practical concern with legal frameworks and policy about conscious pain turning on outcomes of the scientific and philosophical debates. Answers are not straightforward, however, since the function of pain is not simply a matter of avoiding tissue damage.

The experience of pain in humans depends on sometimes competing subsystems (e.g., sensory versus affective-motivational, Långland-Hassan 2017: 251ff.) and can occur independently of nociceptive stimulation. Receptivity to opioids such as morphine can affect non-cortical areas of the nervous system including the brain stem (Rainville 2002). Protective responses such as “nocifensive” flexion withdrawal can occur without awareness (Allen 2004; Roy 2015). Strikingly, a dog’s leg will scratch at the precise spot where an irritant has been applied despite a detached spinal cord (we know from paraplegics that there is no feeling below the point of lesion, Key 2016a; see also Allen 1998: 223). Similarly, the paw of a rat with a severed spine can even learn to distinguish noxious from other stimuli (Grau 2002). In these cases, deflationary hypotheses are favored.

Nevertheless, adaptive response to bodily damage such as guarding or favoring an injured limb, reduced activity, limping, seeking analgesics, or at least quiet spaces to lick one’s wounds, and so on, do not seem best explained by automatic, unconscious mechanisms. Perhaps tellingly, protective and emotional responses are almost totally absent in arthropods (though see Elwood and Appel 2009 on hermit crabs), and likewise insects which don’t appear to care about broken limbs and will continue to feed or mate even when cut in half (Eisemann et al. 1984). Another example is elasmobranch “fish,” such as sharks, skates, and rays which are unperturbed by severe injuries (Rose 2002).

Notwithstanding a recycling of foundational issues, correlational evidence from brain imaging, effects of lesions, and direct stimulation suggest a central role for cortical structures, especially the anterior cingulate, somatosensory, and insular cortices in felt pain in human beings (Bushnell et al. 1999; Price 2000; Apkarian et al. 2005; Craig 2009; Key 2016a). Considerations of neuroanatomy, information processing, behavior and physiological changes, make a strong case for experienced pain in mammals (Shriver 2006; Le Neindre et al. 2017: 138) and birds (Gentle 1992; Wang et al. 2010; Prunier et al. 2013; Calbrese and Wolley 2015). For example, behavioral indicators of pain widely seen in farm animals include vocalizations, abnormal postures, rubbing, licking, and reductions in activity (Prunier et al. 2013). Some (Key 2015; 2016a; Walters 2016) employ a “structure-function argument” whereby empirically derived similarity in neural architecture forms the basis for inferences about shared cognitive functioning, including the experience of conscious pain. Necessary (though not sufficient) conditions for consciousness in humans are also found in nonhumans via lesion studies of mammals and birds and are suggestive of deficits in pain experience (LaGraize 2004; Allen 2005; Shriver 2016). Interpretation of the experimental results is a matter of ongoing dispute (e.g. Key 2016b; Shriver 2016) with the extent of plasticity (i.e., multiple realizability) of cortical functioning and neuroanatomy in need of further investigation.

13 Recent Developments

Several current debates about consciousness in nonhumans focus on various species of fish, cephalopods (squids, octopuses and cuttlefish), and insects with the open-access journal *Animal Sentience* emerging as a clearing-house for exchanges on these and other topics. For example, a target article by Key (2016a) about sentience in fish attracted over 40 responses, among them leading researchers and scholars.

Of vertebrates, fish and reptiles have long been points of controversy, with arguments noting the absence of neocortex, as argued by Rose (2002; see also Rose et al. 2014) setting the agenda for recent discussions. Others counter that teleost fish, such as trout, have nociceptors, respond favorably to painkillers (Sneddon 2003), suffer cognitive impairments such as attention deficits, and exhibit other abnormal behaviors when treated with noxious stimuli (Sneddon et al. 2003; 2011). Chandroo et al. (2004) and Braithwaite and Huntingford (2004) offered initial responses to Rose,

while Allen (2013), Balcombe (2016), Brown (2016), Seth (2016) and Striedter (2016) continue the commentary. Woodruff (2017) offers a neuroanatomical approach with a focus on the pallial divisions of the fish telencephalon that is drawing a vigorous response from philosophers and scientists. Turning to lizards and reptiles, like fish, neocortex is not present though in some neuroanatomical respects they resemble birds (Lohman and Smeets 1991). Cabanac (1999) argues mainly from physiological and behavioral evidence that there are indications of felt pleasure in iguanas, though not toads or goldfish (Cabanac et al. 2009). Reptiles appear to be equipped with only a grab bag of encapsulated modules and Fixed Action Patterns inconsistent with representationalist and integrationist (e.g. Global Workspace) models. Snakes, such as boas and pythons, follow a tightly scripted hunting routine dispensing with any centralized representation of their prey. Even when coiled around a mouse the snake ignores proprioceptive feedback and is guided by smell and random probing in preparation for swallowing (Sjölander 1995; Gärdenfors 1995; Dennett 1995: 346).

As for invertebrates, the case is occasionally made that insects could be sentient, perhaps in virtue of neuroanatomical similarity to the mammalian midbrain (Barron and Klein 2016; Klein and Barron 2016). Physiological and behavioral evidence attesting to sensory integration, learning, and flexible response has also been adduced (Tye 2016). Sneddon et al. (2014) offer a mixture of considerations of varying plausibility concerning crabs. Others have noted that snails, earthworms, honeybees, and crustaceans release adrenal-like hormones when stressed (Elwood et al. 2009). That honeybees recognize faces even from unfamiliar perspectives might be suggestive of mental rotation (Dyer et al. 2005; Dyer and Vuong 2008; Knight 2010). Once again, however, nociception, learned responses to analgesics, and adaptive behavior such as cost-benefit tradeoffs and reduced activity can be accounted for by unconscious mechanisms. Some crabs detour appropriately (Vannini and Cannicci 1995; Cannicci et al. 2000) and spiny lobsters navigate home from novel locations (Boles and Lohmann 2003), perhaps using spatial maps. Yet these may only be automated domain-specific competencies. Even a very good GPS (or face-recognition system) is not conscious.

Finally, among cephalopods, the octopus is especially intriguing. These animals are highly intelligent, adept at learning (Mather 2001), and display a variety of complex cognizing (Godfrey-Smith 2013). The octopus is a notorious escape artist capable of unscrewing jars (from the inside!) and there is no end to the anecdotes about their idiosyncratic resourcefulness, such as the individual who ambushed trespassers with jets of water (Dews 1959). Despite its impressive reputation, caution is in order here as well. Consider that mating behavior suggestive to some of social intelligence (Godfrey-Smith 2013) is reminiscent of competitions between lizards, including a notorious type known as “sneakers” (see Cherfas 1977: 673 for a saltier sobriquet). The lizards employ “strategies” only in the nominal sense that adaptations for traits such as size, aggressiveness, and color are “competing” from the perspective of evolutionary game theory and frequency dependent fitness (Sinervo and Lively 1996). As such, neither consciousness nor (much) cognition is called for. Cephalopod neuroanatomy is also a far cry from mammalian architecture, with 600 million years separating us from a common ancestor (Godfrey-Smith 2013). Even in the grossest terms, the differences are striking. As over two-thirds of its neurons are located in the tentacles, the cephalopod nervous system is highly distributed compared to vertebrates. Unsurprisingly, the case for sentience rests on other considerations, and appeals to multisensory unification in cognitive information processing lead the way (Mather 2008).

14 Conclusion

This survey provides just a sample of the expanding literature on animal sentience (see also Baars 2005b; Merker 2007). A recent review sponsored by the European Food Safety Association runs

the length of a short book and gives a sense of the enormity of the subject. Having turned up at least 2,000 extant works during their initial search, the authors found it practical to retain only a small fraction as reference materials (Le Neindre et al. 2017: 16). Besides its fecundity as a research topic, animal consciousness is a prime example of philosophy's relevance to a robust interdisciplinary conversation overlapping with matters of continual interest to the public and policy makers.

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