

Which Systems Are Conscious?

Readings in *From Brain to Cosmos*

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Abstract

This document consists primarily of an excerpt (chapter 14) from the author's book *From Brain to Cosmos*. In that excerpt, the author uses the concept of subjective fact developed earlier in the book to address a question about consciousness: which physical systems (organisms or machines) are conscious? (This document depends heavily upon the concept of subjective fact developed in *From Brain to Cosmos*. Readers unfamiliar with that concept are strongly advised to read chapters 2 and 3 of *From Brain to Cosmos* first. See the last page of this document for details on how to obtain those chapters.)

For more information about the author's book *From Brain to Cosmos*, or to learn where to find other chapters of the book, please consult the last page of this document.

Chapter 14

Which Beings Are Conscious?

In this chapter I will take up an important question in the philosophy of mind: Which objects in the world are conscious beings? This question is of interest for a variety of practical reasons. It is of ethical interest because of its relevance to the morality of euthanasia. It also bears on the question of the consciousness of nonhuman animals. It is of interest to the student of artificial intelligence because of its obvious connection to the question of machine consciousness.¹

Aside from practical implications, the question "Which things are conscious?" also has significance for our views about the nature of reality. Some philosophers (notably Leibniz² and more recently Charles Hartshorne³) have argued that matter is composed of conscious units. This view cannot be correct unless bits of inanimate matter can be conscious in some sense. Unless we have a way of deciding which beings are conscious and which are not, we cannot evaluate these views in any non-dogmatic manner.

In this chapter I will describe one way to determine, from empirical evidence, whether or not a given being is conscious. More precisely, I will describe a method for deciding whether a physical entity possesses a viewpoint, or a way things seem. This method is not entirely new; it can be regarded as an elaboration of certain ideas of H.S. Jennings, who was one of the pioneers of behaviorism.⁴ (However, the method neither presupposes nor leads to behaviorism.) The central idea of this method also can be found in Locke's argument for animal consciousness.⁵ The method proposed here may prove useful for deciding whether beings are conscious in some troublesome cases in which familiar criteria cannot be applied.

This goal is more modest than it might at first appear. Having a way things seem is not the only interesting feature of conscious beings. The method I will describe here does not allow us to decide whether a thing has any of the other familiar features of consciousness (such as, for example, emotion or thought). Hence it cannot decide whether a thing has consciousness of the kind which we humans would regard as normal waking consciousness. It only allows us to decide whether facts can be the case for an entity at a time — that is, whether an entity's career contains consciousness events.

Immediate Knowledge About Consciousness

Before proposing my criterion for deciding what is conscious, I will review a few of the more familiar criteria which people have used for this purpose.

In Chapter 6 I argued for the possibility of perception of mental states in other subjects. There I suggested that a subject cannot actually witness a consciousness event in another subject, but that a subject may sometimes notice that another subject is undergoing experiences of a particular sort. A consciousness event in a subject does not exist for a consciousness event in another subject, except in the extraordinary cases of merging and dividing subjects. One can know immediately about other subjects' mental states only through one's awareness of facts about those subjects — not by becoming acquainted with the other subjects' consciousness events.

Ordinarily, one knows about the mental states of other subjects after witnessing those subjects' physical behaviors. One is able to know about the inner lives of other subjects only because certain facts about those subjects are the case for one's own consciousness events. Neurologically speaking, this perception involves some sort of integration of sensations of the other subject's body, but it does not involve conscious logical inference. It seems as "immediate" as, say, the visual perception of a simple geometric pattern.

According to the ideas of Chapter 6, one can, under

certain conditions, simply notice that another being is conscious. But this method of determining what is conscious has three severe limitations.

First, this method of determining whether a being is conscious is rather limited in its applicability. It is difficult to see how to apply it to beings very different from oneself. Humans might be able to apply it to higher animals. For less humanlike beings the situation is not as clear. The kind of direct perception of mental states which I described in Chapter 6 requires a certain *rapport* between observer and observed. At very least, one must be able to recognize the behaviors of the observed being as symptoms of subjective states similar to one's own. Emotional sympathy is one case of this *rapport*; I discussed this case in detail in Chapter 6. But no suitable *rapport* seems possible between the average human and, say, the average flatworm or the average 2000-model computer. A suitable *rapport* between a human and a conscious electron (that is, an electron as Leibniz might have conceived it) seems even less likely. Even if flatworms, electrons, and simple computers were conscious, they almost certainly would lack any mental processes sufficiently humanlike to excite "gut" reactions in most humans.

A second difficulty with the method of noticing consciousness in other beings is its uselessness for ascertaining that a being is *not* conscious. One's inability to notice consciousness in another being is not sufficient evidence to conclude that that being is not conscious. This limitation of the method of noticing mental states does not

arise from the error-proneness which I discussed in Chapter 6. It is a separate difficulty.

This error-proneness which I just mentioned is the third (but most important) limitation of this method of perceiving other minds. In Chapter 6 I discussed this fallibility and identified its sources. Fallibility of this general sort occurs with all methods of knowing based on observation, but it afflicts this particular method rather severely.

Inferential Knowledge About Consciousness

Another way to establish that a being is conscious is to infer that fact logically from observed facts about that being's behavior. Philosophers have discussed this option extensively in connection with the problem of other minds.⁶ I have discussed it to some extent in Chapter 6. There are at least two known candidates for ways to decide by deliberate inference whether a being other than oneself is conscious.

One traditional solution to the problem of other minds involves inductive reasoning. I will summarize this known solution here. To deploy this solution, I begin with the knowledge that certain mental states of mine normally are associated with specific kinds of actions or behaviors. From this I infer inductively that similar actions or behaviors in other beings who resemble me also reflect mental states.⁷ This argument provides a way to find out what is conscious: simply determine which sorts of behaviors indicate consciousness in oneself (or in humans generally) and infer

that any being which exhibits such behaviors is conscious.

This known method of determining what is conscious has a well-known and crucial weakness: it depends upon inductive inferences from highly restricted classes of instances.⁸ As a solution to the problem of other minds, it asks one to generalize from a premise about oneself to a universal conclusion about all entities similar in some respects to oneself. As a way of determining whether non-human beings are conscious, it requires one to generalize further from a statement about human subjects to obtain a conclusion about all subjects. Induction from a single case or from a very special class of cases always is hazardous. But generalizing from oneself to all subjects is especially questionable because of the highly unusual character of one's experience of oneself. Confronted with the inductive solution to the problem of other minds, one is tempted to ask "How do I know that it isn't just *me* that works that way? How do I know that consciousness, as I feel and understand it, isn't just an idiosyncrasy of mine?"

Using human-like behaviors as criteria of consciousness for other beings also is suspect, in view of the very peculiar mental capacities of humans. Given the weaknesses of inferences from oneself, one obviously can criticize an inference from all humans by asking "How do I know it isn't just *humans* that work that way? How do I know that this link between behavior and consciousness is not peculiar to humans, a result of some very peculiar circuitry found only in *human* brains?"

Searle has suggested that comparisons of "the causal basis

of the behavior"⁹ of humans and animals can be used to justify the belief that a dog is conscious. As Searle recognized, this method does not share the weaknesses of a solution to the problem of other minds which relies on behavior alone.¹⁰ However (as Searle also recognized), this method does not extend easily and directly to the simpler animals.¹¹ Nor, I would add, is it useful on Leibnizian electrons. It cannot rule out *a priori* the possibility of consciousness in very simple entities, since for all we know there may be causal bases for behavior which are not like ours and yet which give rise to viewpoints.

There is another possible inferential method for deciding what is conscious. That method involves finding *logically sufficient* connections between consciousness and particular physical circumstances.¹² If one could find a physical condition which entails that an object is conscious, and if for any observed object one could determine through observation whether that condition holds, then one could decide, at least in some instances, whether an observed object is conscious. Unfortunately, this method remains far beyond our reach, given our present lack of knowledge about the nature of consciousness. Some philosophical views of mind, including materialism and epiphenomenalism, suggest that the requisite sufficient conditions might, in principle, be found. These views entail that mental processes are tied to physical ones in such a way that consciousness exists if certain physical conditions hold. If we could settle on one such theory, or could find such

conditions without presupposing any of these philosophical theories, then we might be able to construct a general test for the presence of consciousness in any being we observe. Unfortunately, we do not know of a way to do this. Hence this method of determining what is conscious remains impracticable.

Consciousness Is a Sharp Quality

All of the above methods for determining which beings are conscious appear to be either unreliable, presently impracticable, or of limited applicability. Fortunately, there is another way to determine which beings are conscious. This method relies both upon empirical facts and upon certain *a priori* principles, but it lacks many of the limitations of the other two inferential methods described above. It hinges upon one crucial property of consciousness: the fact that consciousness is, in one sense, what logicians call a *sharp property*.¹³

A sharp property is a property that is not vague — one that does not admit of degrees and borderline cases, as (for example) hotness and coldness do. If we forget about the other characteristics of consciousness and simply characterize consciousness as having a way things seem, then consciousness is a sharp property. An entity possesses consciousness now if and only if its career includes a consciousness event which occurs now — or, equivalently, if a fact is the case for that entity now. A being for which

even one fact now is the case has a "point of view" or an "inner world."¹⁴ This is true no matter how insignificant, "small," or simple the fact may be. To be genuinely unconscious, a being would have to lack *any subjective content whatsoever*. There would have to be *no* facts which are the case for it now, for even one such fact makes the being conscious. Thus, consciousness is a sharp quality in the sense that a given object either possesses it or lacks it. There are no genuine intermediate cases. Anything that has a "viewpoint," no matter how dim, or that has any subjective content, no matter how simple, is conscious without any ifs, ands, or buts, and only that which lacks all such content is nonconscious.

Dennett has argued that there is no sharp dividing line between the classes of conscious and unconscious beings.¹⁵ This claim appears to conflict with what I have just said, but actually it probably is compatible with my claim that consciousness is sharp. When I used the word "conscious," I used it in the sense of possession of subjective fact (recall Chapter 2). Dennett did not use the word in precisely this sense; hence it is possible that consciousness in my sense is a sharp property even if Dennett's claim is true. But if the two claims really are incompatible, then Dennett's claim must be rejected.

If so much as one fact is the case for an entity, then that entity has the property of being conscious. If no fact is the case for an entity, then that entity does not have the property of being conscious. Since one or the other of these two cases holds, a given entity either really possesses

consciousness or does not possess any consciousness at all. There can be no borderline cases in which something is "sort of" conscious. Stated more graphically: If one or more facts are the case for John, then John is conscious. If zero facts are the case for John, then John is not conscious. One or the other must be true.

None of this can conflict with the observed fact that consciousness has many different *levels*.¹⁶ A single subject may pass through different kinds of consciousness, such as dreaming sleep, drowsiness, and waking. (In some of these states a being appears to be only marginally conscious.) Humans and other animals may be able to have consciousness of many different kinds. One can conceive of possible beings which have consciousness of still other sorts, such as that of simple beings with "minute perceptions,"¹⁷ which come about as close to nonconsciousness as one can get without going completely blank. The experiences of such beings would have very meager content. But all of these levels and kinds of consciousness are only differences in the *quantity and quality of content*. In all of them there still are some subjective facts. As long as a being has any subjective content at all, as long as something is the case for that being at a time, then that being is conscious. Any contamination with subjective fact, no matter how marginal, removes an entity from the world of nonconscious items and places it squarely in the class of conscious beings.

This point is important enough to bear repeating. Consciousness may admit of many kinds and levels which

differ both qualitatively and quantitatively from each other. There may be vast, crucial variations in the kind and quantity of content. However, this does not imply that consciousness is *instantiated* in varying degrees. If things seem any way at all, then there is consciousness. The differences among different levels and types of consciousness are variations in the number and character of subjective facts which are the case for a subject. The *presence* of consciousness is another matter altogether. It is strictly two-valued. Either there is some subjective content for a being or there is not. If there is some such content, then the being is conscious; one can proceed to inquire as to what level or kind of consciousness it has. If there is no such content, then the being is nonconscious — like a brick in a world in which no inanimate thing is conscious.

States like somnolence, which we might colloquially describe as involving "a little bit of consciousness," are genuine cases of consciousness. Strictly speaking, they are not marginal or intermediate cases of consciousness itself. Descriptions of degrees of consciousness, like "a little bit conscious" and "fully conscious," may be useful in describing sleepy or drugged states, but they are deceptive. Such descriptions are not analogous to "a little tall" and "definitely tall." They are more closely analogous to a mathematician's descriptions of lines as "a little bit curved" or "strongly curved." All lines answering to either of these descriptions are *curved*, and that's that. They are not borderline cases between curved lines and perfectly straight Euclidean lines.

By now it should be clear what "consciousness is a sharp quality" means. A being either is conscious or is not; any state that seems to constitute a borderline case actually is a non-marginal case of consciousness which happens to involve content of an impoverished kind. A being which is conscious is radically different from one which is not. It has an "inside" (however content-rich or content-poor) as well as an "outside." A nonconscious being lacks such an "inside." For a conscious being, there truly exists (to borrow Nagel's words) "something that it is like to *be*" the being,¹⁸ no matter how rudimentary and dim that "something" is. For a nonconscious lump there is no such thing. Though admitting of degrees and levels, consciousness does not admit of borderline cases which could equally well be called cases of nonconsciousness.

The conclusion that consciousness is a sharp property actually is not as strong a thesis as it may appear. It is a consequence of the specialized way in which I have defined "consciousness." If we take "consciousness" to mean the presence of subjective fact (as I did in Chapter 2), then we find that consciousness is a sharp quality. If we had defined consciousness in a more naive way, such as the presence of sensation, feeling, and/or thought, then we would not have found this; indeed, we would have found that consciousness, like tallness, has degrees. It is important to remember that the kind of consciousness which we are investigating here is just the presence of subjective fact, as described in Chapter 2. The conclusions of this chapter will fall into better perspective if one keeps this in mind.

The Continuous Alteration Principle

The conclusion that consciousness is sharp implies a general principle which is useful for determining which beings are conscious. The following example is meant to motivate this principle. Although this example is grotesque and should not happen in reality, it is no odder from a philosophical standpoint than many personal identity examples, such as those I discussed in Chapter 12. (As I mentioned earlier, this argument, and the conclusion with which it ends, have precedents in the work of Jennings and Locke.)

Suppose that some Martians had a medical means for slightly weakening all the mental capacities of a human being. For concreteness' sake, let this be a medical procedure P which reduces one's mental and psychological powers, as quantitated on appropriate scales of measurement, by 1 percent. For example, application of P might lower intelligence just enough so that a measure of the victim's intelligence, on some scale, goes down by 1 percent; lessen emotional intensity just enough so that the response (however measured) to a given experience becomes 1 percent weaker; weaken sensation just enough so that certain measured responses to stimuli are 1 percent weaker; and so forth. Suppose that this weakening involves some actual weakening of the subjective feelings involved — not merely a measured weakening of behavior (if one thinks there is a

difference between these two kinds of weakening). I will not attempt to ask whether the subjective change is quantifiable.

Now suppose that the procedure P is performed repeatedly on a "normal" human being S. During the first application of P, all of S's psychological measurements decline by 1 percent. Clearly this change does not make S into a nonconscious lump. It merely transforms S into a slightly less intelligent and responsive person. There are many genuine conscious subjects who still rank far below S on all the scales. On the second repetition, S's already reduced mental levels decline again by 1 percent. This quantitative change also will fail to eliminate S's consciousness. S remains conscious, but the measurements now have only 0.99×0.99 , or 98.01 percent, of their initial values. Suppose, for the sake of argument, that while P is being repeatedly performed, nothing else, such as complete cessation of brain function, is allowed to happen to S. After N repetitions of P, a measurement on S whose original value was M has the value $M \times (0.99)^N$. As N becomes large, this modified value becomes smaller than the normal range of human values for the quantity being measured. However, there are many mental or psychological capacities which S never entirely loses.

If S keeps being simplified in this way, and abrupt changes (like a complete loss of mental content or death) are somehow prevented, then the final result will be something having behaviors similar in complexity to those of, say, a dog. However, the quantitative simplifications of S by

means of P must result in a being for which *some facts still are the case*. Nothing has happened that could result in the loss of all subjective facts. Let us call this new being S'. (I leave open the question of whether S' is identical in any sense to S.)

If one tried to do this experiment in practice, undoubtedly it would have a fatal outcome. However, this is not because of any conceptual impossibility in the story. A person can begin to have experiences considerably simpler and poorer than normal ones, and yet still have conscious experiences of some kind. It is likely that none of the iterations of P could change a conscious being into an entirely unconscious one. We may safely suppose that S', like S, is conscious.

An Objection Rebutted

A possible technical objection to this argument is the claim that it is a *sorites*. A sorites is a fallacious argument involving a property that seems to be preserved by the gain or loss of a small part. The classic "Tall Man" argument is a typical example of a sorites.¹⁹ This argument begins with the observation that if one reduces the height of the tall man by just a little, then one still has a tall man. By repeating this reduction, one can wrongly conclude that when only a few feet remain the man still is tall. One might think that my argument about S and S' is wrong for the same reason.

A moment's reflection shows why my argument is not a sorites. The Tall Man argument is invalid because the

property of tallness is vague; as one reduces the height of the tall man, one inevitably runs into borderline cases of tallness.²⁰ My argument about S and S' does not face the same difficulty. There are many different kinds of consciousness, and some of them can be thought of naively as degrees of consciousness. However, when it comes to the actual possession of a viewpoint, there can be no borderline cases between consciousness and utter unconsciousness. Hence consciousness lacks the vagueness upon which a sorites depends. One cannot take away consciousness entirely by reducing the amount of content by a tiny fraction. Since consciousness is sharp, the argument about P is not a sorites.

For the record, I will write out the argument about S and S' in a way which makes its validity clearer. If we let $S_0, S_1, S_2, \dots, S_N$ be the stages in the simplification of S (where S_0 is S and S_N is S'), then the argument looks like this:²¹

S_0 is conscious.

If S_0 is conscious, then S_1 is conscious.

If S_1 is conscious, then S_2 is conscious.

...

If S_{N-1} is conscious, then S_N is conscious.

Therefore, S_N is conscious.

This argument is not a sorites and is valid for any value of N . The reason that it is not a sorites is that *consciousness is sharp*.

One also might wonder whether S would ever reach a stage where the smallest possible reduction of the psychological measurements is greater than 1 percent. In that case, one can change the argument to use the minimum possible reduction. One also might wonder whether there is a stage at which any further reduction of the measured quantities would lead to zero values for some of these quantities. This circumstance might falsify an assumption which I made during the example: that subjective content is not entirely eliminated at any step. This could happen, although one might be able to postpone it by using even smaller steps, or different kinds of steps which reduce the complexity of content. Probably, the only stage at which no reduction at all is possible is the stage at which very few facts are the case for S . And a being at such a stage would be far simpler than the S' described above.

The above reply to the sorites objection underscores the meaning of the conclusion that consciousness is sharp. One can get from a tall man to a short man via a series of trifling changes; there is no distinct threshold between tallness and shortness, no sharp difference between the two. But there is a sharp logical difference between consciousness and nonconsciousness, if one defines "consciousness" as the possession of a way things seem. One can't get from this

kind of consciousness to utter non-consciousness by means of a series of insignificant mind-contractions — unless, of course, one cheats and sneaks in the removal of *all* remaining content. Such a change is not a logically necessary consequence of finite, quantitative mind-contractions. The tallness of a tall man can be pared away gradually by shrinkages of the order of millimeters. The presence of subjective fact in S cannot be pared away gradually — either S undeniably is conscious or S is not conscious. If S's mind kept on shrinking, S would remain conscious until the last trace of content was erased. At that moment, consciousness would disappear abruptly.

The Shrinking Mind Revisited

In the above example of the shrinking subject, S' exhibited behaviors far simpler than those of any ordinary human being. For argument's sake I suppose that the behavior of S' is reduced to the simplicity of a dog's behavior — that is, that all of the observable behaviors of S' are what one would expect of a dog, or are much like those of a dog in their complexity and sophistication. (For example, S' might have a poorer sense of smell and better vision than a real dog, but both S' and a typical dog exhibit sensitivity to their surroundings in qualitatively comparable degrees.)

If S is conscious, then it is plausible to suppose that S' also is conscious. If S' is conscious, and a dog has behaviors

which are similar in sophistication (if not in all details) to those of S', then it is plausible to suppose that *a dog also is conscious*.

This conclusion is not surprising. What is surprising is how we derived it.

It may be objected that the behavior of the dog is *not* a simplified version of human behavior — that one cannot get from S to the dog by making small changes, since the dog is a being of a fundamentally different kind. This objection has a point, but it still is not a successful objection. Although S' is not a dog, the differences between S' and the dog are differences that should not make the difference between consciousness and unconsciousness. These differences do not tell against the view that there is some way things seem to a particular organism. For example, the differences between a dog's senses and ours does not make or break consciousness. A normal human with full, unreduced mental capacities, who gradually lost visual acuity and acquired a keen sense of smell, would not lose consciousness by virtue of that change. A change in subjective fact would be involved, but consciousness would not be lost. One class of subjective facts would be swapped for another. The same can be said for a dog which gradually became nearly anosmic while acquiring 20-20 vision. There are other changes, besides sensory ones, which also cannot eradicate consciousness. These changes include (for example) changes in instincts and drives, in emotional responses, and in ways of interpreting the world.

One can generalize the above argument with arbitrary

pairs of beings taking the place of S and the dog. One arrives at the following general principle:

Continuous Alteration Principle (CAP). Suppose that T and U are two beings, T is conscious, and it is conceptually possible that there are beings T_1, T_2, \dots, T_N such that each being in the series T, T_1, T_2, \dots, T_N , U, besides T itself, is related to the previous member of the series by a change of one of the following two sorts:

- (1) a small quantitative change in some feature or features of behavior or of the internal processes which cause behavior;
- (2) a substitution of one kind of perception or behavior for another kind, which, if applied in a gradual manner to T or to U, would not result in T's or U's becoming unconscious.

Then it is probable that U is conscious.

As it stands, the CAP is extremely vague. It contains vague phrases, such as "small quantitative change," "kind of perception or behavior," and "gradual manner," which badly need to be assigned more precise meanings. Nevertheless, we can use the principle as a rough guide for making educated guesses about what might be conscious. And even

in its present, far-too-imprecise form, the CAP allows us to determine which beings *might* be conscious. If the CAP tells us that an entity is conscious, then we should not rule out the possibility that that being actually is conscious, since there is at least a grain of suspicion that it might be conscious.

Consciousness in the Biological World

One can use CAP as a rough-and-ready test for the presence of consciousness in a wide variety of things. In principle, one can apply CAP as a test for consciousness to animals, to elementary particles (if one has read Leibniz), to computers, or to any other observable objects one wishes to test.

The CAP strongly suggests that higher animals like dogs, horses and bats are conscious.²² This is not much of a surprise. The mental simplifications and extensions required to make humans resemble dogs (for example) seem to be conceptually possible. The CAP does not say whether the consciousness of a higher animal is much like that of a human. It does not even tell us whether higher animals have selves of a humanlike sort, since it does not tell us whether they have self-awareness.

The CAP also strongly suggests that one does not have to be a mammal to be conscious. It seems likely that it is logically possible (though not now technically possible) to alter a human being to resemble, in a general way, a frog. It

is possible to imagine intermediate states which satisfy the hypothesis of CAP. This suggests that if CAP holds then amphibians possess consciousness of some sort.

We can speculate about the possibility of consciousness in various biological systems. When we think about this possibility, we must remember that we are using "consciousness" in a very restricted sense here. To be conscious in this sense, one need not be conscious in the way that humans are conscious. One does not even have to be "awake." I am calling an object "conscious" if and only if there is a way things seem to it — that is, if and only if some fact is the case for it. Thus the claim that a frog possesses "consciousness" amounts only to this: that an instance of seeming is part of a frog's history. It does *not* imply that frogs possess intelligence of any mammal-like kind, or any thoughts, feelings, intentions, or plans such as we have. Least of all does it imply that a frog has a self, or self-awareness. All it implies is that a frog has subjective characteristics of some sort. A fact can be the case for a frog at a time.

A moment ago I said that the CAP does not imply that a frog has a self. If a frog undergoes consciousness events, then it is a conscious subject at least part of the time; hence it can be thought of as having a self in this very weak sense. But being a conscious subject is not the same as being a person (recall Chapter 5) or having a self in the usual sense of that word. If a frog were a conscious subject in the technical sense of "conscious subject" which I have used, it would not imply that a frog has a psychological self of the

sort which humans have.²³

So Which Beings Are Conscious?

Using the CAP, we have arrived at a partial, tentative answer to the question in this chapter's title. We have found reason to suppose that consciousness is a pervasive phenomenon in the world of vertebrate animals. These animals very likely possess viewpoints and undergo consciousness events of some sort.

Since the concept of consciousness which we are using is so minimalistic, it is not preposterous to ask whether invertebrates also have some kind of consciousness. I will not try to answer this difficult and provocative question here. However, I will mention some relevant facts about the behavior of simpler organisms. Invertebrates exhibit highly complex behaviors, sometimes strongly reminiscent of vertebrate behaviors.²⁴ This is true even of *unicellular* organisms, such as amoebas²⁵ and bacteria.²⁶ Bacteria, in particular, exhibit what amounts to an elementary version of memory, as well as fairly complex adaptive and goal-seeking behaviors.²⁷ Regardless of whether such organisms have experiences, it is clear that they raise interesting questions in the philosophy of mind. Philosophers would do well to study them more often.

The question of the possibility of computer consciousness is another important issue which I do not plan to take up here. However, there is no reason why the CAP could not

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be used to approach this problem. Since each kind of hardware and each program has its own distinctive traits, we must apply the CAP to computers on a system-by-system basis instead of trying to apply it to very wide classes of machines.

Notes

Bibliographical references, cited here by author and year, can be found in the "Works Cited" section of the book. Numbers following such citations are page numbers unless otherwise indicated.

Chapter 14. Which Beings are Conscious?

1. There is a large current literature on the prospects for machine consciousness and other mental features of machines. Interesting older sources include these articles in Hook 1960: Danto 1959; Hook 1959; Lachman 1959; Scriven 1959; Watanabe 1959; Weiss 1959.

2. Leibniz 17xx, paragraphs 66-70 (p. 159).

3. See Hartshorne 1984, 60-63 and Hartshorne 1962, 191-196.

4. A very interesting older discussion of invertebrate behavior is found in Jennings 1906. Jennings, a pioneer of behaviorism (see Jensen 1962, xvi), noticed the "continuity" (Jennings 1906, 335) of behavior through the biological world, and thought it consistent with the hypothesis of invertebrate consciousness (336). The continuous alteration principle, which I will introduce below, can be regarded as a sharpened version of his ideas about this continuity. For some comments on Jennings' work, see Jensen 1962.

5. Locke 1689, Book 2, Chapter 9 (pp. 148-149).
6. See for example Ayer 1958, 243-254. My discussion in the next two paragraphs owes much to these comments of Ayer's (particularly Ayer 1958, 249-250). I discussed the problem of other minds in Chapter 6.
7. Ayer 1958, 249. (My version of this argument, in this sentence and the last, follows Ayer's version closely, though perhaps not perfectly.)
8. Ayer 1958, 249-250.
9. Searle 1992, 73.
10. Searle 1992, 71-74, 21-22.
11. Searle 1992, 74.
12. See Searle 1992, 74-75, for a similar idea not involving logical entailment.
13. Searle (1992, 83) has noted what appears to be the same fact; he has pointed out that "a system is either conscious or not" even though it can have "different degrees of consciousness."
14. Hume's and Locke's oyster examples come to mind at this point (Hume 1739-40, Appendix, p. 634; Locke 1689, Book 2, Chapter 9, p. 148). The expression "point of view" is used, in a sense rather similar to the one I have in mind, by Nagel (1974, 437).
15. Dennett 1991, 447.
16. Searle also recognized that this fact is reconcilable with the fact that "a system is either conscious or not" (Searle 1992, 83).
17. Leibniz 17xx, par. 21 (p. 151); see also pars. 19-20 and 22-24 (pp. 150-151), and Schrecker 1965, xv.

18. The quoted phrase is from Nagel's characterization of conscious organisms in Nagel 1974, 436.

19. See Forbes 1985, 164, 171-172. I have drawn on Forbes 1985 for information about sorites arguments in general.

20. See Forbes 1985, 164, 169.

21. The presentation of the Tall Man argument in Forbes 1985 (172) has the same form, though of course the subject matter is different.

22. Nagel's suggestion (in Nagel 1974, especially pp. 439-440) that a bat's experience is in some respects unimaginable to us does not threaten this conclusion about bats!

23. Dennett has argued that a bat lacks a significant "selfy self" (Dennett 1991, 448).

24. See note 4 above for references on the work of Jennings, who explored invertebrate behavior, noted the similarities to vertebrate behavior, and anticipated some of the ideas I will present in this chapter.

25. See Jennings 1906, 1-25.

26. See Alberts et al. 1983, 757-763, on a bacterial behavior which can be viewed in this way. See also Jennings 1906, 26-40.

27. I refer to *chemotaxis*, which is discussed in Alberts et al. 1983 (757-763), and which is referred to in the following title of a section of a chapter: "Bacterial Chemotaxis Is a Simple Kind of Intelligent Behavior" (p. 757).

Works Cited

(Note added later: This list pertains to the entire book, not just to the excerpts.)

This list contains all works used as sources of information or ideas in this book. It is not a comprehensive bibliography of any sort. Many of the topics discussed in this book are subjects of vast bodies of published literature; others, such as introductory physics, are covered in many good books. In cases of these sorts, I concentrated on typical reference sources which I felt would be useful to the reader, or which I personally found helpful. (In areas of active research, these may not be the most current works available.) No slight is intended toward any work not mentioned in this list.

Dates following author's names are meant to be (approximate) publication dates unless a separate publication date is given, in which case they are meant to be (approximate) dates of first publication or creation. The latter dates come from the works themselves or their front matter, or occasionally from Durant 1953. Dates listed in this section should not be treated as exact; some may be educated guesses.

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About This Document and *From Brain to Cosmos*

Mark Sharlow's book *From Brain to Cosmos* was out of print at the time this document was prepared (late 2010). Most of the chapters of *From Brain to Cosmos* appear in the following documents, which may be available online:

“An Introduction to Subjective Facts” (chaps. 2-3)

“Knowledge of How Things Seem to You” (chap. 4)

“Personal Identity and Subjective Time” (chap. 5)

“Subjective Facts and Other Minds” (chap. 6)

“Time and Subjective Facts” (chaps. 5, 7-9)

“Conscious Subjects in Detail” (chaps. 5, 10-12)

“Beyond Physicalism and Idealism” (chap. 13)

“Which Systems Are Conscious?” (chap. 14)

Each of the above documents has “Readings in *From Brain to Cosmos*” as its subtitle and Mark F. Sharlow as its author.

Copies of the printed book may be available through sellers of used books.

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