Nature and Consciousness

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What is the place of consciousness in nature? The standard view in science is that consciousness arrived late and will exit early. Nearly fourteen billion years ago, the Big Bang launched a universe replete with spacetime, matter and fields, but devoid of life or consciousness. On earth, life emerged less than four billion years ago, and consciousness sometime after that. Within the next five billion years, any flickers of consciousness that persist on earth will be snuffed out as the sun expands into a red giant, boiling away earth's water and atmosphere and, possibly, incinerating it in toto. Any flickers that exist elsewhere in the universe will be snuffed out a few billion years later, probably by a Big Rip in which all matter is torn apart by dark energy.

The standard view is that consciousness has a biological basis. Within the standard view, there are two main camps. Reductionists claim that consciousness and conscious experiences are *identical* to certain physical or functional processes of the brain. Emergentists claim that consciousness and conscious experiences *emerge* from physical or functional processes of the brain, but are not identical to these processes.

Neither camp has produced a bona fide scientific theory. There are, of course, hypotheses on offer. Perhaps, for instance, what is critical for conscious experiences are neuronal microtubules with special quantum properties, or reentrant thalamo-cortical loops with certain informational properties, or a system of neurons that can act as a global clearing house. But, in each case, a miracle is needed at the critical step where consciousness appears. No one knows how to make the key move, from neural activity to conscious experience, without invoking, tacitly or explicitly, a miracle. This utter lack of plausible ideas for exorcising the miracle is well known and much discussed, often being referred to as the "hard problem" of consciousness.

The standard view is that the hard problem will be resolved as further empirical research, particularly into the neural correlates of consciousness, uncovers critical facts and inspires new theoretical ideas. This is a defensible view, with precedents in its favor, such as the demystification of life that followed the discovery of the double-helical structure of DNA.

But the hard problem might instead be a symptom of a false assumption in the standard view. I suggest that this is indeed the case and propose, on evolutionary grounds, that a key false assumption is this: Consciousness has a biological basis.

My proposal is based on an analysis of the evolution of perception using the tools of evolutionary game theory. To understand this analysis, a brief background on current theories of perception

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It is now well understood in the cognitive and neural sciences that perception is not just a passive record of an objective world, but is instead an active process of construction. Human vision, for instance, constructs all the colors, shapes, depths, motions and objects that we see. Research in computational vision has, in the last three decades, developed mathematical and computational models of this constructive process that are sufficiently precise to be implemented in working computer-vision systems.

The thesis that perception is construction is now widely accepted. But in addition, a second, stronger, thesis is also widely accepted: Perception is *reconstruction*. The idea is that our perceptual constructions estimate true properties of the real world. The colors, shapes, depths and motions that we see are the best estimates that our visual systems can construct of the true colors, shapes, depths and motions in the environment.

The argument typically given for this stronger thesis is evolutionary: Natural selection favors those who see more truly. More accurate perceptions are more fit; we are the offspring of those who happened to see more truly.

This argument has prima facie plausibility, but, of course, must be subjected to the normal process of scientific testing. One appropriate and powerful way to test it is provided by the tools of evolutionary game theory. Within a computer simulation, we can create a variety of artificial environments and a variety of perceptual strategies that compete for resources in those environments, we can let these strategies compete for thousands of generations and then see if, in fact, truer perception confers a selective advantage.

In general, it doesn't. Quite often a simple perceptual heuristic, one that does not see the truth but instead uses simple tricks, will drive true perception to extinction. This might be surprising, until one recognizes that information is not free. For every bit of information that perception gleans about the environment there is a cost in time and energy. In evolution, the race is to the swift and frugal. Slower perceptions make one easier prey; more complex perceptions require more calories to compute, calories for which one must forage and kill.

Natural selection shapes perception to be a collection of fast and cheap tricks that happen to work in some niche. Truth is too slow and expensive a strategy and, should it happen to arise, is quickly driven to extinction. A humorous example of the strategies that confer survival is given by the jewel beetle *Julodimorpha backewelli*. Male beetles have a simple perceptual heuristic for finding

females: look for their wing casings, which are brown, glossy and dimpled. As it happens, glossy brown beer bottles, with dimples for a better grip, appeal to this heuristic more powerfully than do real female beetles. The result is that the males forsake the females and swarm the beer bottles, attempting to copulate. Their perceptual heuristic worked well in their niche for millenia; the introduction of beer bottles into their niche foiled the heuristic and threatened to drive the species extinct.

The computer desktop, with its windows interface, is a useful analogy for the kind of perception that confers survival. A blue, rectangular icon in the lower right corner of the screen represents a file, but the file itself is not blue, rectangular or in the lower right corner of the computer. The icon is useful even though it is not true; its color, shape and position are not true reports of the color, shape and position of the file. Indeed, the icon is useful, in part, because it is not true. The icon is there to hide the truth, to hide the complexity of diodes, resistors, and magnetic fields.

Perception is like a user interface. It is useful in part because it hides the truth. We see the results of this throughout biological nature in the forms of mimicry, camouflage and supernormal stimuli.

Spacetime is the desktop of the user interface of *Homo sapiens*. Objects in spacetime are among the icons of this interface. Colors, textures, shapes, smells, sounds and pitches are among the properties of these icons. This desktop and its icons are useful, in part, because they are not true. They are tricks that let *Homo sapiens* survive long enough to reproduce. Perception is construction, but it is not reconstruction.

Perhaps less intuitively, the brain and its neurons, are also among the icons of our interface. They are the result of simple perceptual tricks, shaped by natural selection, that hide the truth. Neurons are the symbols *Homo sapiens* happens to use; they are not estimates of the true structures and causes in nature. Neurons resemble objective reality as much as a blue rectangular icon resembles a file; which is to say, not at all.

So the assumption that consciousness has a biological basis is false. Neurons are no more responsible for the appearance of consciousness than a blue rectangular icon is responsible for the existence of a file. Seen in this light, the hard problem of consciousness becomes an artifact of a false assumption.

This false assumption is a special case of a much larger, and widely held, false assumption: Objects in spacetime have causal powers.

Objects in spacetime appear to us as they do because of the way *Homo sapiens* happens to be shaped by natural selection to see. Objects and their properties do not reveal the true structures and causes in nature. Objects are simply icons employed in our user interface.

This interface theory invites the following question: If that train speeding down the tracks is simply an icon of your user interface, why don't you step in front of it?

The answer is that I won't step in front of the train for the same reason that I won't carelessly drag a file icon to the trash can. Although I don't take the file icon *literally* (the file is not blue or rectangular), I do take it *seriously*. Dragging the icon to the trash has real consequences; I could lose many hours of work. Similarly, our perceptual icons have been shaped by natural selection to facilitate our survival: A panther icon is a good cue to run, a cliff icon a good cue to stand back. We had better take these icons seriously. But we need not take them literally.

It is natural to worry, at this point, that the argument here leads inevitably to skepticism, i.e., to the conclusion that humans can know nothing about objective reality. It doesn't. It merely discards a particularly simplistic theory of perception and reality, a theory that says our perceptions substantially resemble objective reality. The skeptic might be right; it is well known that skeptical arguments cannot be logically refuted. But the interface theory of perception does not entail skepticism, nor does it entail ignoring the data of neuroscience. It allows science to proceed with the normal cycle of hypothesis and experiment to refine its theories of the relation between perception and reality. Discarding a particularly simplistic theory is, in this regard, good progress.

As this progress continues, we will find new frameworks within which to address our first question: What is the place of consciousness in nature?

Donald Hoffman, PhD, Professor of Cognitive Sciences at the University of California, Irvine, delivered the J.B. Rhine Address at the banquet of the 52nd Annual Convention of the Parapsychological Association at the University of Washington in Seattle. His talk, titled *Consciousness and the Interface Theory of Perception* presented a non-materialist solution to the mind-body problem. More information about Dr. Hoffman's research and activities can be found at his personal website:

http://www.cogsci.uci.edu/personnel/hoffman/hoffman.html

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