SCIENCE

The Case Against Reality

A professor of cognitive science argues that the world is nothing like the way our experiences through our senses.

By Amanda Gefter and Quanna Magazine

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As we go about our daily lives, we tend to assume that our perceptions—sights, sounds, textures, tastes—are an accurate portrayal of the real world. Sure, we don't see all of it clearly, or in great detail, but what we see and hear is pretty much what there is to see and hear. Cognitive scientist Donald Hoffman, a professor of cognitive science at the University of California, Irvine, Hoffman has spent the past three decades studying perception, artificial intelligence, evolutionary game theory, and consciousness. He argues that our ordinary ideas about the nature of perception are wrong, to put it mildly. What's more, he says, we have evolved not in spite of but for this magnificent illusion, as it maximizes evolutionary fitness by driving truth to extinction.

Getting at questions about the nature of reality and disentangling the observer from the observed, is a science that straddles the boundaries of neuroscience and fundamental physics. On one side you'll find researchers crunching their data one painstaking or lucky breakthrough at a time; they grind away toward understanding more about the ordinary laws of physics—just give me a first-person consciousness experiment. This is the aptly named "hard" problem.

On the other side are quantum physicists, marvelling at the strangeness that quantum systems dwell, seem to be affected by objects localized in space until we come along to observe them. Experiments alter experiments but destroy defining consistent states—that if we assume that the particles that make up the experiment, and the experimenter, are independent entities existing in a single universe. The central lesson of quantum physics is clear: There are no public objects sitting out there to some preexisting spaces. As the physicist John Wheeler put it, "Until at a number of ordinary circumstances we see that the world exists 'out there' independent of us, that view can no longer be maintained."

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Yet so, says Donald D. Hoffman, a professor of cognitive science at the University of California, Irvine. Hoffman has spent the past three decades studying perception, artificial intelligence, evolutionary game theory, and consciousness. He argues that our ordinary ideas about the nature of perception are wrong, to put it mildly. What's more, he says, we have evolved not in spite of but for this magnificent illusion, as it maximizes evolutionary fitness by driving truth to extinction.

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Gefter: You've been computer simulations to show this. Can you give an example?

Hoffman: Suppose in reality there's a resource. Hot water, and you can quantify how much of it there is in an objective reality—very little water, medium amount of water, a lot of water. Now suppose your fitness function is here, as a little water gives you a little fitness, medium water gives you medium fitness, and lots of water gives you lots of fitness—in that case, the organism that sees the truth about the water in the world can win, but only because the fitness function happens to align with the true structure in reality. Now suppose the fitness function is not like that. It's a fitness function that more natural is. Still water, very little water gives you the most fitness, then much water you dinnen, and only somewhere in between is good for survival. Now the fitness function doesn't mirror the resource in the real world, but that's enough to avoid truth in extinction. For example, an organism tuned to fitness might see small and large quantities of water resource, or say, it can indicate lion fitness, whereas they might see intermediate quantities as green, and that's all they need to know to survive. The organism doesn't need to see the truth. It need only see distinctions between small and large—it only sees such—even though such a distinction exists in reality.

Gefter: But how can an entity that can't see the truth survive in an organismic survival?

Hoffman: There's a metaphor that's only been available to us in the past 30-40 years, and that's the desktop interface. Suppose that's a blue rectangular icon on the lower right-hand corner of your desktop, and inside that there's a folder, and inside that folder is a photograph of lions in the future right corner of your computer desktop. I mean, you know that on the only things that can be interested about anything on the desktop—is, is it blue, is it yellow, position, and shape. These are the only attributes available to you, and yet some of them are true about the lions. The blue rectangular icon means the lions are probably far away. That's an interesting thing. You could not form a true description of the truth of the component of your screen view of reality but you confined to the desktop. And yet the desktop is useful. That blue rectangular icon guides my behavior, it hides a complex reality that I don't need to know. That's the key idea. Evolution has shaped us with perception that allow us to survive. They guide our behavior, they hide the complexity of reality that we don't need to know. And that's pretty much all of reality, whatever reality might be. If you had to spend all that time figuring it out, the tiger would be you.

Gefter: So everything we see is one big illusion?

Hoffman: We have shaped to have perceptions that keep us alive, so we have to take them seriously. If I see something that I think of as a snake, I don't pick it up. If I see a crack, I don't step in front of it. I'm confined to symbols to keep me alive, so I have to take them seriously. But it's a logical flaw to think that if we have to take it seriously, we also have to take it literally.

Gefter: If snakes aren't snakes and trains aren't trains, what are they?

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Hoffman: Snakes and trains, the particles of physics, have no objective, observer-independent features. The snake I see is a description created by my sensory system to inform me of the fitness consequences of my action. Evolution shapes acceptable solutions, not optimal ones. A snake is an acceptable solution to the problem of telling me how to act in a situation. My snakes and trains are my mental representations; your snakes and trains are your mental representations.

Gefter: How did you first become interested in these ideas?

Hoffman: As a teenager, I was very interested in the question: We're conscious, but what is it? What is consciousness? I was hoping that I was a neuroscientist, and I thought that was going to be my ticket. So I decided I would go to graduate school in neuroscience. I was hoping to get a Ph.D. in neuroscience, I was hoping to find that and find it I'd be, you, I'd like to know, what is that special magic beyond the machine? So eventually in the 1980s I went to the artificial intelligence lab at MIT and worked on machine perception. The field of vision research was enjoying a newfound success in developing mathematical models that worked well. And I was fascinated by the notion that there's a mathematical structure, so I thought it might be possible to write down a formal structure for observation that encompassed all of them, perhaps all possible modes of observation. I was inspired to try that by Turing. When he invented the Turing machine, he was trying to come up with a notion of computation, and instead of pointing balls and whistles on a, he said, Let's get the simplest, most general dumb mathematical description that I can imagine, and that's what I'm going to call computation. And I was hoping that I could do the same thing, I wondered, could I provide a similarly simple formal foundation for the science of observation?

Gefter: A mathematical model of consciousness.

Hoffman: That's right. My intention was, there are conscious experiences. I have pains, tastes, smells, all my sensory experiences, moods, emotions and so forth. So I'm just going to say: The goal of this consciousness structure is to set of all possible experiences. When I'm having an experience, based on that experience I may want to change what I'm doing. So I need to have a collection of possible actions I can take and a decision strategy, given any sensory experience, what action I'm going to take. So I'm going to add that to which doing. I have a space, I'm of experiences, a space I'm of actions, and an algorithm. I'm just too choose a new action given my experiences. Then I posited, a W for a world, which is also a probability space. Somehow the world affects my perceptions, so there's a perception map P from the world to my space of experiences. And then I'm going to have a map, I'm from the space of actions to the world. There's the entire structure. The dynamic. The claim is: This is the structure of consciousness. I just that was there as people have something to show as.

Gefter: But if there's a W, are you saying there is an external world?

Hoffman: Here's the striking thing about that. I can grab the W out of the model and stick a conscious agent in its place and get a circuit of conscious agents. In fact, you can have whole networks of arbitrary complexity. And that's the world.

Gefter: The world is just other conscious agents?

Hoffman: I call it conscious realism. Objects in fact are conscious agents. Just pieces of mine. Interestingly, I can take two conscious agents and have them interact, and the mathematical structure of that interaction then satisfies the definition of a conscious agent. This mathematics is telling me something very, very deep about the nature of consciousness and how it interacts. There's a concept, mathematics. We have homologies in our brain, that when you do a spike-brain operation, a complex transversion of the corpus callosum, you get clear evidence of two separate consciousnesses. Before that thing happened, it seemed there was a single unified consciousness. So it's not implausible that there is a single conscious agent. And yet it's also true that there are two conscious agents there, and you can see that when they split. I can take two conscious agents and have them interact, and I can show that I can take separate otherwise-isolated conscious agents and, when they interact, and keep doing this ad infinitum. It's interesting to suppose all this doing.

Gefter: If it's conscious agents all the way down, all first-person points of view, what happens to science? Science has always been a third-person description of the world.

Hoffman: The idea that we're doing is measuring publicly accessible objects, the idea that objectivity results from the fact that you and I can measure the same object in the same more-or-less-accurate way, and that's—it's very clear from quantum mechanics that that idea has to go. Physicists have had to give up that idea. But I think that's very, very difficult for them, because I think about it, I can talk to you about my headache and hope to show I am communicating effectively with you, because you've had your own headaches. The same thing is true of pain and the sweet and the sour and the serious. Just like you have your own headaches, you have your own sweet. I can measure it relatively similar to mine. That's an assumption that I can make. So labs. Start the source of my communications, and that's the best we can do in terms of public physical objects and objective science.

Gefter: It doesn't seem like many people in neuroscience or philosophy of mind are thinking about fundamental physics. Do you think that's been a stumbling block for those trying to understand consciousness?

Hoffman: I think it has been. Not only are they ignoring the progress in fundamental physics, they are often explicit about it. They'd say quickly that quantum physics is not relevant to the aspects of brain function that are crucially involved in consciousness. They are certain that it's just to classical and computational, that quantum effects are irrelevant. Penrose and others are spinning many, conscientious examples of quantum, perhaps dynamical properties as well. There are all very classical notions under Newtonian physics, where time is absolute and objects exist absolutely. And then Newtonian mechanics modified as well as relativity does that modify quantum physics. They don't and dismissive of the incredible insights and breakthroughs that physics has made. Those insights are out there for us to use, and yet my field says, "We'll stick with Newton, thank you. We'll stay 300 years behind in our physics."

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