

DON HOFFMAN INTERVIEW PART THREE

Hello again, Ars Technica listeners. This is the third installment of a three-part interview with UC Irvine quantitative psychologist Don Hoffman, and his wildly original, and mind-boggling take on the nature of root reality.

If you haven't yet heard parts one or two, there are links on the page where this player's embedded, and I strongly suggest that you go back and listen to them before this installment.

And with that - back to my conversation with Don Hoffman.

TRANSITION MUSIC

Don Hoffman: We'll try to solve the mind body problem the other direction, instead of starting with the physical world that's not conscious and trying to figure out how we can boot up consciousness from unconscious ingredients. Maybe we can start with a mathematical theory of consciousness and then show how we could boot up space time and physical objects as just an interface that conscious agents use to interact with each other.

Rob Reid: Is it accurate to say that you currently believe with high confidence that space time is a user interface, and that what we perceive has very, very little connection, if any, to objective reality? That's something you're highly confident in. Whereas the notion of the social network of conscious agents, that's a theory that you're working on right now?

Don Hoffman: I think the right scientific attitude toward any scientific theory is not one of belief. It's a matter of understanding. So, it's up to a scientist to really understand the theory, to understand its implications, to understand it's mathematics, and then to follow its predictions, test the predictions and try to break the theory. Good scientists try to take theories and push them to their limits, and when they break we are quite happy because we're about to learn something new.

Don Hoffman: Evolution by natural selection entails that none of our perceptions are veridical. And that entails that space and time is just a construct. Now, the next step that I've taken, which is to say, well, maybe objective reality is not space time, maybe it's this vast social network of conscious agents. That's a big step. It's a big leap, and it'll be up to me to try to make it completely mathematically precise and make new predictions. So, I propose it not because I'm sure I'm right. I'm trying to be precise and bold, so that others can show me where I'm wrong.

Don Hoffman: That's how science works. We make bold and mathematically precise proposals, look at the implications, see where they go wrong, and then see how we have to change the mathematics and that's when we start to make real progress.

Rob Reid: One of the things that has popped out of the math and the work that you've done thus far is the notion that lower level consciousnesses can combine into higher level consciousness. Two independent consciousness could create a greater one. One thing that might appear to support that is these split brain surgeries that were much more common back, I think, in the '50s and '60s. You actually met one of the people who did a lot of those surgeries.

Don Hoffman: Yes, I had the pleasure of getting to know and become friends with Joe Bogen, who was a surgeon who did a number of these surgeries.

Rob Reid: Dozens of them, right? Not just one or two but many-

Don Hoffman: Dozens. The problem was epilepsy that could not be treated with the drugs that they had at the time. In some cases that made the life of the patients just unbearable. If you have a seizure every hour and you can't drive, you can't do anything. You could fall down and knock yourself out, it's nasty. In desperation, they tried something. There's a part of the brain that has bad electrical activity. It's called an epileptic focus. Maybe it's over in your left hemisphere somewhere. Once that focus starts sending off random electrical activity in the brain, it spreads like a storm. And you get this cortical storm that goes from the left hemisphere across something called the corpus callosum. It's a band of fibers that connects the left hemisphere of the brain to the right hemisphere of the brain.

Don Hoffman: Then the right hemisphere of the brain gets swept up in the storm. And the whole brain goes down. This surgery was radical and desperate. But the idea was if there's an epileptic focus, say in the left hemisphere, if we cut the corpus callosum, this band of fibers that connects the right and left hemisphere, maybe only the left hemisphere will go down. It will go down with epilepsy. But the right hemisphere will stay alert. So, the person can stay awake and they can take care of themselves. They won't fall down. It was desperate, but they decided to go for it.

Rob Reid: It worked, right?

Don Hoffman: It was a clinical success. It was spectacular. The number of epileptic seizures dropped dramatically and the lives of these people was dramatically changed. Most of the family members said, "I can't see anything different about the person now that they've had their brain cut in half. They seem pretty normal, except now they don't have as many seizures."

Rob Reid: But the odd thing is there is now a left half and right half of the brain that have no communication between them.

Don Hoffman: That's right.

Rob Reid: You used a great description in your writing. You said it's almost as if we've had this terrible outbreak of computer viruses and malware, and we've decided to cut the fiber optic cable between Europe and the United States to stop it. But lo and behold, it was working. So, Joe Bogen was one of two surgeons who carried out a lot of these procedures. You met him in a very interesting circumstance. What was the name of the society you were part of?

Don Hoffman: It was called the Helmholtz club. It was a secret group of about a dozen to 18 scientists that met here at UC Irvine over in the university club.

Rob Reid: This sounds like the beginning of a great horror movie; secret group of brain scientists, but it would probably be in a more menacing town than Irvine, but continue.

Don Hoffman: The meetings were clandestine, not because we were doing something nefarious, but because Francis Crick was a member of the group. Francis was so famous that if anybody knew he was on campus, we wouldn't get any work done.

Rob Reid: Francis Crick being one of the two people who discovered the double helix DNA molecule.

Don Hoffman: He was brilliant and he had demystified life. Before Crick and Watson made their discovery, vitalism was a belief that maybe living things were different from non-living things because they had some *Élan vital*, some mysterious special force that kept them alive. So, Crick was really after doing the same thing for consciousness that he'd done for life. He wanted to demystify it.

Don Hoffman: The Helmholtz club we were meeting to pursue that idea, how exactly does brain activity create conscious experiences? We went at it for a couple decades.

Rob Reid: So, this puzzle that we were talking about earlier, this is something you've been hammering on since the '80s and the '90s.

Don Hoffman: That's right. From mid '80s, all the way up until 2004, when Francis died.

Rob Reid: Then Biogen who had done all this seminal work with the split brain surgery, he was a regular member, right?

Don Hoffman: That's right. He came and gave a talk and then became a regular member.

Rob Reid: Tell us about some of the crazy things that started to manifest from these people who had these seemingly very successful surgeries. Who was it that got them into the lab, Sperry?

Don Hoffman: Roger Sperry. He won the Nobel Prize for the work that we're about to talk about.

Rob Reid: So, Biogen didn't get it for chopping the brains in half, Sperry got it for coming in and figuring out there's the scary thing of it.

Don Hoffman: That's right, for figuring out what was going on. To come up with a psychological explanation for it. I can give you a kind of experiment that Sperry would do. I'll update it with the technology. Suppose I put you in front of a computer screen, and I put a little X in the middle of the screen, and you look at the X. And then, while you're looking at the X, I flash up for a 10th of a second a phrase like key ring. I make sure that the word, key, appears just to the left of the X that you're looking at, and the word ring appears just to the right of the X that you're looking at.

Don Hoffman: It flashes up there for a 10th of a second then disappears. Then I ask you, "What did you see?" Now, if you're a normal person without a split brain operation, it's easy. A 10th of a second is plenty of time, you'd get it right 100% of the time. But if you ask a split brain patient, they will say I saw the word ring.

Rob Reid: They will not say key ring, because they only saw ring with their right eye which reports to the left side of the brain.

Don Hoffman: It's not quite the eyes, the word ring appeared to the right of where they were looking, in the right visual field. The right eye and the left eye both see the right visual field. But the right visual field gets mapped by the weird wiring of the brain from the eye to the brain, it only goes to the left hemisphere.

Rob Reid: Regardless of which eye it comes into.

Don Hoffman: Exactly right.

Rob Reid: The right visual field goes into the left hemisphere.

Don Hoffman: Exactly right. That is strange, but that's the way it's wired. And then the left visual field goes directly to the right hemisphere. Now in normal people, you have a corpus callosum, which then sends the information across. The right hemisphere sends this information to the left hemisphere, the left hemisphere sends it to the right-

Rob Reid: One half says, "I got key." The other half says, "I got ring." They say, "Together we got key ring."

Don Hoffman: Exactly right. You put it together and you get key ring. But with the split brain patient, that liaison between the hemispheres is gone. The right hemisphere sees the word key. The left hemisphere sees the word ring, and nobody saw key

ring. Only the left hemisphere talks. The right hemisphere can understand language but it can't talk.

Don Hoffman: When you ask the person, "What did you see?" The left hemisphere is talking and it only saw the word ring. And so the person says, "I saw the word ring." If you ask them, "What kind of ring? Was it a key ring, a wedding ring, a doorbell ring?" The person will go, "I don't know. Just ring is all I saw." Now, if you blindfold them, give them a little box with lots of little stuff in it, a key, a ring, a pencil, a spoon, all sorts of little stuff you can put in a box. You ask them, "Blindfolded, please use your left hand to pick up the object that corresponds to the word you just read." The left hand will go through and it will sort, pick things up, put them down until it finds a key. Even if it happens to pick up a ring, it'll fill it, and put it back down and keep searching until it finds a key.

Rob Reid: So, now the other side of the brain that is not verbal, it saw its own word and it can't talk, but it can pick things up and it can feel things. And now you're asking essentially that entity, "What did you see?" And it's only picked up key. This suggests you have to conscious beings.

Don Hoffman: That's right. I should mention that the right hemisphere controls the left hand.

Rob Reid: Right.

Don Hoffman: And it feels what the left hand is feeling. The left hemisphere controls the right hand-

Rob Reid: And the tongue and the speaking.

Don Hoffman: Left hemisphere controls speech.

Rob Reid: Yes.

Don Hoffman: That's right. That's why the left hand is telling you what the right hemisphere knows about, and the right hand is telling you what the left hemisphere knows about.

Rob Reid: This is the work that Sperry did. It doesn't just suggest, it seems to scream that there are two conscious beings. One of which is seeing the left visual field, one is seeing the right visual field. One is controlling the left hand, one is controlling the right hand. Only one of them gets to speak.

Don Hoffman: That's right. The contents of their conscious experiences can be utterly different. One is having the experience of key, the other's having the experience of ring. You can actually ask questions to these hemispheres to find out about their personalities. And it turns out, they have different personalities.

Rob Reid: They'd have to write their answer, I guess?

Don Hoffman: The left hemisphere can talk.

Rob Reid: Right.

Don Hoffman: If you ask a person, you can find out about the personality of the left hemisphere, you can ask the right hemisphere and have the left hand spell out with Scrabble pieces, or to write with a pencil.

Rob Reid: Hopefully, it's a lefty, because then they can write with a pencil. But if they're right handed person, they're going to have to spell with Scrabble letters. That's interesting. So, Sperry literally interviewed the left hemisphere and the right hemisphere separately and came up with different personality types.

Don Hoffman: Well, it was later work, I think, besides Sperry. But what people found, the personalities are very, very different. The left hemisphere is more upbeat. The right hemisphere is not quite as happy. One case when they asked a person what they wanted to be when they graduated from college, the left hemisphere said, "This guy wanted to be a draftsman." And the right hemisphere spelled out, automobile racer. Very, very different personalities.

Rob Reid: V.S. Ramachandran, a professor at UC San Diego, found one split brain patient in which the left hemisphere believes in God, and the right hemisphere is an atheist.

Don Hoffman: Because the Secret Society of brain scientists was not cool enough, we now need to talk about alien hand syndrome.

Rob Reid: Right. In some of the split brain patients, not most, but some, you get someone who's got a naughty left hand. I'll give you a concrete example. The person is getting dressed. The right hand is trying to pick out a conservative dress that's appropriate for work, and the left hand pulls out some slinky red thing that's good for Friday night or Saturday night, but it's not good for work, and the left hand refuses to let go of it and won't help put on the correct dress for work.

Don Hoffman: This is in a split brain patient.

Rob Reid: This is in a split brain patient.

Don Hoffman: So, there's a fight. As the one hand is trying to button up the conservative dress, the left hand is unbuttoning it. Another case where the person is trying to make an omelet and left hand just throws in a whole egg, shell and all, and throws in a salt shaker trying to ruin the omelet. So, apparently the left hemisphere likes omelets, and the right hemisphere does not like that omelet. They try to wreck it so they'll have some cereal or something instead.

Rob Reid: That's right. This kind of suggests that there are multiple consciousnesses that are unifying in the whole sense of self that we end up with. Is this also related to the term Society Of Mind in any way?

Don Hoffman: It is, Marvin Minsky had a book about the Society Of Mind, and he was a physicalist. So, he wasn't taking the point of view that I am, that consciousness is fundamental, and we can have conscious agents combine to create new conscious agents. But he was saying that there were these computational processes, physical process in the brain that could create minds. And that you could have multiple minds that were being created by this computational processing. His Society Of Mind view is very, very different from-

Rob Reid: But nonetheless, your math has suggested that consciousness can combine and become entirely new emergent consciousness. Is that something that's come out of the mathematical work that you're doing, or is that more of a philosophical supposition?

Don Hoffman: That's mathematics and was a surprise to me. I have this abstract notion of a conscious agent. But then I've written down a completely precise formal structure, and I've published it.

Rob Reid: Could you tell us what the journal is for those whose math goes far beyond my own?

Don Hoffman: Right, it's The Frontiers Of Psychology Journal, and it's called Objects Of Consciousness. It's by me, Donald Hoffman, and also Chetan Prakash is co-author on it. He's a mathematician that I work with. We have an absolutely precise definition of a conscious agent. One of the interesting implications of that definition, I discovered as I was playing with it, is that when I took two conscious agents and had them interact, and looked at the system of two conscious agents, that system actually satisfied the definition of being a single conscious agent.

Don Hoffman: So, this continues ad infinitum. You can keep taking pairs of agents and combining them. This suggests a really interesting structure. There are these simplest agents that have just two perceptions like red and green, and two actions. I call them one bit agents. They're the simplest agents possible. They have the most simplest free will decisions to make. You take two of these one bit agents, have them interact, you get a two bit agent. Now, you take two of the two bit agents and have them interact, you get a four bit agent.

Don Hoffman: You can keep doing this until you actually get agents that have infinite number of bits. Now you have infinite consciousnesses that come out of this mathematics, and we have complete mathematical control understanding these combinations and the dynamics so we can study it. But here we're dealing with infinite consciousnesses. We're now treading in the realm of theology and religion, but treading in a new way. You might think of God as being an infinite

conscious agent. But I can now precisely define what I mean by an infinite conscious agent, and I can prove terms. These are no longer hand waves or canons of belief, these are theorems and proofs and that follow from the mathematics.

Rob Reid: Working downward, if I work downward from myself going down in the direction of the one bit and two bit agents, that might notionally be split. The hemisphere, now, you've got two simpler entities and split split split. You might have consciousness all the way down. Going up, staying in consensus reality, might it be something like the culture of a company, or the shared spirit of a team or a nation. Might those be actual consciousnesses?

Don Hoffman: Absolutely. This theory of conscious agents seems to imply that that's going to happen. That when you get a company and people working closely together, or a nation, you're going to get new conscious entities that are arising. Now, we may not experience that because we're just part of the constituents. We're not the new entity that arises. So, we won't be able perhaps to experience that higher entity.

Rob Reid: We might not be able to detect it either.

Don Hoffman: Well, that's going to be a question I look at my mathematics. Is there any way for us as the lower level agents to understand anything about the agents above us? I'm very interested in that question. I can't wait to see if the mathematics will give us some way of looking above.

Rob Reid: Then you start treading towards theology, I guess, if you say all human consciousnesses sum up to a super-agent that's way, way up there. That could be when you start getting into the direction of God, et cetera.

Don Hoffman: That's right. Exactly, right.

Rob Reid: One last thing, is there a connection between your emerging view of conscious agents and a field that's called pan Sikhism?

Don Hoffman: There are various versions of pan Sikhism. I don't want to mischaracterize, but here's a standard one. Every physical object, say an electron has not only physical properties like position and momentum and spin, it also has a unit of consciousness. It actually has a conscious experience and also some notion of agency. So, it's more of a dualistic point of view. There really is a physical world, there really are particles with real physical properties, but they also have these conscious experiences. It's very, very different from my point of view, because I'm saying that the physical world doesn't exist apart from my perceptions.

Rob Reid: So pan Sikhism would it say that this chair has some kind of a mental or conscious life, is it all particles are conscious, or is it all things that look like solitary, unitary objects to us humans? Is a teddy bear got a consciousness? It

almost sounds animist. Where do they draw the lines between consciousnesses?

Don Hoffman: This is where pan Sikhists themselves will debate which kinds of objects are legitimate to say these have conscious experiences? Is a mere aggregate of sand enough to have conscious experience? They will debate that. But in most cases, they'll say that for example, an electron has consciousness, a proton has consciousness and a hydrogen atom, which is electron plus a proton together, that also has consciousness.

Rob Reid: Independent consciousness of the sub particles.

Don Hoffman: Independent of those. So, you've got what they call the combination problem. This is the big open technical problem for pan Sikhism, how do you take the conscious agents of the electron and of the proton to create a new subject for the hydrogen atom? And how do you take the individual experiences of the electron and proton and map them into the experiences of the hydrogen atom? Pan Sikhism is a philosophical idea. So far, it has not been cashed out into a mathematically precise scientific theory.

Rob Reid: Now you've got two books that are coming up. I have read the current draft of one of them, which is coming out, is it early 2019?

Don Hoffman: 2019.

Rob Reid: That is the one that really talks primarily about fitness before truth, the user interface, most of what we've talked about. And the second book, which will be sometime in the indeterminate future is going to go into the conscious agent stuff that we're talking about now, which remains a work in process for you. What will be the title of the first book?

Don Hoffman: Right now, the working title is The Case Against Reality. Then the subtitle is, Why Evolution Hid The Truth From Our Eyes. It's going to be published by Norton in the United States, and Penguin in the UK.

Rob Reid: Probably several months from now, January-ish or something like that.

Don Hoffman: That's right.

Rob Reid: People can look for that. And then is there anywhere else where people can find you and your work online?

Don Hoffman: If you just Google Donald Hoffman H-O-F-F-M-A-N, my homepage is one of the first that comes up. The key place on my homepage is a link called the [inaudible 01:16:06] In my [inaudible 01:16:06], I have links to all of my papers, and there for free. So, you can look at all my papers, I've got podcasts and videos, and

there's links to them, and most of them are free. I've got to talk with the Dalai Lama, and talks with all sorts of interesting people.

Rob Reid: Got it. Well, all the way from disabusing me of the notion of a flat earth, this has been quite a wild tour of one lens through which one can look at reality. I thank you very, very kindly.

Don Hoffman: My pleasure. Thank you very much.

Rob Reid: I bet you weren't expecting that huh? Your logic and intuitions maybe rebelling against Don's worldview right about now. But as I said at the start of the episode, wrestling with his arguments is a great exercise. Both because the actual truth has to be at least as weird as anything he's come up with, and he might actually be right. Don now has the biggest research budget he's ever had. He's assembled a really high octane team to help him tackle this stuff over the next few years. Needless to say, stay tuned.

Rob Reid: After our recorded conversation, Don and I hung out in the courtyard outside his office for a bit, talking about several related ideas. And I hit him with a concept I've been gnawing on for about 20 years since I first became aware of certain claims of String Theory. To my astonishment and delight, Don didn't consider my aging pet theory to be laughable or something to be dismissed out of hand. The heart of it ties String Theory to neuroscience in a way that I assumed had been explored already, at least conceptually. But Don, at least isn't personally aware of anyone who's looked into this factor, which surprised us both. Because if anyone had worked on this stuff, Don would almost certainly be aware of it.

Rob Reid: I flushed it out for him pretty extensively in our conversation, and although Don strikes me as being an extremely nice person, don't think he was just being nice when he said it was novel and interesting. So, patrons, if you're interested in a take on reality that's approximately as weird as Don's own take on reality, head on over to [patreon.com/Rob Reid](https://patreon.com/RobReid), R-O-B R-E-I-D, have a listen to the bonus content from this week's episode, and please, tell me what you think about it.

Rob Reid: Patreon is a simple discussion space that you should be able to access and post on quite easily. And I'll absolutely read and respond to everything that you post. Of course, my scenario is nowhere near as well developed as Don's, and it's certainly nowhere near as mathematical or scientific. But what he shares with his thinking is that it's quite explicable through analogies that I think anybody will find accessible. I of course, use those analogies in my Patreon post. It's also hard to dismiss out of hand. And if String Theory is correct about the nature of reality, the odds may actually favor some aspects of my scenario being true.

Rob Reid: Don't worry, you don't need a mastery of String Theory to understand it. You just have to be aware of one aspect of it. Possibly, the single easiest aspect of String Theory to understand, and I'll do my best to explain it to you. Now, I hope

non-patreons will at least consider joining us over at Patreon as well and becoming patreons. If you sign up at \$5 a month or more, you'll find hours of content that you haven't yet heard, illuminating every episode going clear back to the beginning of February. Plus, of course, you'll hear my crazy pseudo theory.

Rob Reid: If Patreon isn't your thing, or even if it is, I hope you'll consider spreading the word about the podcast because that's my other vector to survival. As mentioned before, there are multiple tweets about this episode to choose from, as well as a Facebook post. And of course there's always the direct and very tactile approach of body tackling anyone you know who you're sure will love this show, and insisting they get with the program and download it.

Rob Reid: Finally, if you happen to be on an iPhone right now and happen to be using Apple's podcasts app with a little purple icon, the totally free 22nd approach to supporting this show is to rate it, or write a review of it. Writing review takes a bit more than 20 seconds, I'll admit. But whichever way you go, here is the strangely unintuitive way to do this. First, even if you're already a subscriber to my show. Indeed, if you're listening to it right now, you need to search for the show's name. In my version of the software, the Search button is in the lower right corner of the screen, so hit the little magnifying glass. Next, select the teeny window that appears at the top of the screen and type in the words After On. The After On icon should then come up in the bottom left corner of your screen, click that. You should then be looking at a listing of my episodes toward the top of the screen. Right under the After On icon, you'll see three long rectangular buttons. The middle one should be reviews. Click that.

Rob Reid: Finally, toward the bottom of the screen, you'll see the words, write a review, then click that. I told you it was complicated. At the next window, you can just rate the podcast which takes no time at all. Or if you feel like it, write a review, which I understand Apple likes even more than just a rating. Whichever way you go, hit send, and you're done, and we're done. Thank you for listening.

END INTERVIEW ELEMENT OF PART THREE

TRANSITION MUSIC

So Ars Technica listeners - here we conclude the third and final installment of my interview with Don Hoffman. I do hope you enjoyed it .

And if you do enjoy my work, I hope you'll consider visiting my site, at after-on.com. Or, just type the words after-on into your favorite podcast player, and scroll to through the episodes. You'll find tons of stuff about life sciences genomics and synthetic biology. Conversations about robotics, privacy and government hacking, cryptocurrency, astrophysics, drones, and a whole lot more.

Or, you could just join me next week, here on Ars. Where we will have another hopefully-fabulous serialized interview, with another deep thinker.

OUTRO MUSIC