How Free Will Probes Mind and Consciousness: Stuart Kauffman

Transcript - Long

Robert Lawrence Kuhn:
Stu, I've been obsessed, literally my whole life, with the nature of consciousness. Sometimes it expresses itself with, what is free will, or, why we think the thoughts that we, we have the experiences. I did my doctorate in brain science, not that that helped me any understand consciousness. I want to ask you – I want to come to you and, and, and see what your thinking is from your work in complex systems and really thinking very radically about how the universe is constructed. You've got to consider consciousness.

Stuart Kauffman:
With terror, I have. Um, it turns out I've been thinking about it, uh, since about 1994, having done philosophy of mind when I was a young man at Oxford and Dartmouth. Um, so, let's begin with Descartes because we know Descartes. So, Descartes says, you know, there's two stuffs, Res Cogitans, thinking stuff, and Res Extensa, his mechanical world view. And he immediately runs into the problem well, well, Rene, that's dandy and you're a French gentleman, but exactly how does Res Cogitans act on Res Extensa? How does this mind stuff do anything to, the material world? Um, and he tries the pineal gland. And people looked for purple stuff but they didn't find any, so it sort of faded. But it really faded with Newton, who gives us his three laws of motion, differential and integral calculus and universal gravitation and creates the mechanical world view, uh, in precise form, in classical physics, that, that Descartes envisioned and gave us analytic geometry that, that led to calculus.

Robert Lawrence Kuhn:
Okay.

Stuart Kauffman:
Well, now you've got the following problem for the past three hundred and fifty years. Um, take the Mind-Brain Identity Theory, which I roughly hold to, um, that the mind and the brain are identical. Then you've got the following problem. If the brain is a classical physics deterministic dynamical system, like a bunch of billiard balls on a billiard table, well, what do you do with the billiard balls? You say, Isaac, what should I do? And Isaac says, I gave you the equations, dummkopf, write them down, measure the initial and the boundary conditions, integrate the equations, and you'll get the trajectory of the balls. That means that the current state of the balls on the table is a sufficient condition for the next state of the balls on the table. That's the causal closure of classical physics. Essential to the problem. Same thing if the brain is a deterministic dynamical system; it might be chaotic, but it's still deterministic. Then, if that's right, goes the standard philosophic argument. First of all, there's nothing for mind to do to the brain. The brain's already a deterministic system.

Robert Lawrence Kuhn:
Right, that's why a lot of people say the mind is an illusion.

Stuart Kauffman:
Right, a lot of people say the mind's an illusion. They're nuts, okay? My mind isn't an illusion. Um, but worse, there's no way for mind to do it. What's it supposed to do; make the billiard ball swerve? Okay, bad enough that the –

Robert Lawrence Kuhn:
Right, so, that's a deterministic system, therefore there's no free will and consciousness is probably, uh –

Stuart Kauffman:
Exactly. All that stuff. So that's the problem. Given the science that we know, and led by Roger Penrose, who, whose arguments I disagree with, but who was the first one to say the word consciousness in public, okay. Uh, I share the hope the quantum mechanics may help us, and the reason, the reasons are many. But first of all, it breaks the causal closure of classical physics. I'll give it to you in just one version. In Feynman's version of quantum mechanics, it's a sum over all possible histories. Okay? So, it's, it's indeterminate. And you have to say of the photon going through the famous two slit experiment, that it possibly does and possibly does not go through the left slit, okay?

Robert Lawrence Kuhn:
Look, quantum mechanics does bring in determinacy, but how does that – how does that help you, if you're equating the brain with the mind? Because you're assuming that the, the product of neurons, is, if you're an identity , is your conception of when you see my black shirt, that your feeling that you have inside of you, of, of seeing my black shirt, you're saying that is the sequence of neuronal firings, even if they're, they're indeterministically, uh, generated by a quantum mechanical sum of all histories.

Stuart Kauffman:
Well, let's get – before we get to that, which is huge, let's get to the problem with quantum mechanics and free will, okay? So, I'm a deterministic person, and I walk down the street and I pick up a frying pan and I bang you on the head and I kill you. Not my fault.

Robert Lawrence Kuhn:
Right, right.

Stuart Kauffman:
And indeterministic.

Robert Lawrence Kuhn:

Your neurons made you do it.

Stuart Kauffman:

My neurons made me do it. But the other one is, okay, a little bit of quantum randomness comes in, and I walk down the street and I pick up a pan and I hit you over the head and I go to court and I say, not my fault –

Robert Lawrence Kuhn:

Totally random.

Stuart Kauffman:

Just, just totally random. I'm not – so, I don't have a responsible free will. I think I know how to beat it. And uh, I filed a patent on it, I believe it so much. Uh, and I call it a Trans-Turing System. So, I need to tell you a little teeny bit about open quantum systems. Uh, this is a system in an environment. And the open quantum system can use what's called phase information into the environment. When it does so, it undergoes a process called decoherence, and becomes effectively classical. Some people say classical, some people say classical, for all practical purposes. I fell in love with it, because decoherence is acausal. There's no causal process at all. You just lose phase information. Now, now we've got a way to answer Descartes; mind, if it's quantum decohering, can act – not act; it can have consequences for classical matter, without acting causally on matter. I've just answered Descartes, but only once, okay? To answer more than once, I have to imagine that, once a system is decohered, it can recohere and become quantum again. That means fluctuating between being quantum and classical and back. It's turning out that that's now thought to be possible. So, first of all, there's a theorem due to a guy named Shaw that says that if you take a quantum computer, and it's got decohering degrees of freedom, you can inject information into it, and make them recohere. So, that's a theorem. There are now several papers that say you can have a decohering system and make it recohere. They're, they're theory, they're not experiment yet. But I want to believe it. So, let's believe it. Now I have a way, of having a quantum decohering mind, having consequences acausally on matter, but doing it many, many, many, many times. So, I've answered Descartes, in principle. Now, the question becomes, how do I get a responsible free will, and what's consciousness? There are just enormous questions. Um, so, here's what a Trans-Turing System is; it lives in this, what I call, the poised realm, with my co-inventors, um, between quantum and classical. It inherits from quantum mechanics the indeterminism of quantum mechanics. I won't go into the details. But it's also classical, so it inherits the non-randomness of classical mechanics. So, it's both indeterminate and non-random. Now, out of the indeterminacy and non-randomness, I think there's a chance to get a responsible free will, cause it's not random, but it's not determinate. So, it's not like me hitting you over the head with a frying pan. It's a long argument. I think you need a lot more to get a responsible free will, that I struggled with in a paper that's now impressing the Alan Turing centennial volume, called Answering Descartes Beyond Turing. At my age of 72, you get to be presumptuous in your titles. Um, last thing, what's consciousness? For a variety of reasons, that are long to go into, when you're in this dense paper of mine, I have a hypothesis that's testable. In quantum mechanics, the most mysterious thing is quantum measurement. So, you know, you have the two-slit experiment and the photons go through and they make marks on the screen. The marks on the screen are the measurement events. Nobody understands it in quantum mechanics; it's never been derived from quantum mechanics, internally. Without going into all arguments, which are long and tortuous, let's just make the assumption that consciousness is associated with quantum measurement. Um, now, here's what's bad about it. It hides consciousness, which is mysterious, in measurement, which is mysterious, and so you could say, why don't you jump into the lake? And, fair enough. But now, let me tell you an experiment to test it. Uh, so, I did fruit fly genetics for years. You can anesthetize fruit flies with ether. You can select on fruit flies so that it takes less and less and less and less ether to anesthetize them, straightforward experiment. Then you can use genetics to find the proteins that are mutated in the selected flies that are trivially anesthetized, or maybe it takes no ether, you can find the normal or wild type proteins in the flies, and you can ask a question. Do the wild type proteins carry out quantum measurement, and the mutant proteins not carry out quantum measurement? And I submit to you that it's a doable experiment, or one of the family of them, if you found that the answer were yes, we'd both look at one another and say, you know what? Maybe consciousness is associated with quantum measurement. Would it prove it? Of course not. Is it an experiment? Yeah. Therefore, are we talking about science, not just philosophy? Yeah. Do I think it's a worthwhile experiment? Boy, I sure do. And if I were younger I might do it, but I hope somebody does it.

Robert Lawrence Kuhn:

So, integrating it together, at this stage of science, how do you view consciousness?

Stuart Kauffman:

So, my view of it has evolved out of trying to answer Descartes. Uh, and Descartes gives us Res Cogitans and Res Extensa, thinking stuff and, uh, the mechanical world view, taken by Newton into Newton's equations and determinism, uh, his three laws of motion and integration, and differential calculus, the mechanical world view, which then leaves us with the famous problems. Which is, if the mind, if the brain is a deterministic dynamical system, um, then you can't have a responsible free will. Um, and there's nothing for mind to do, because it's deterministic, and there's no way for mind to do it. Um, to answer that I truly believe you have to break the causal closure of Newtonian mechanics, of classical physics. And the only way I can see to do it is to, is to use quantum mechanics, in the physics we know, okay? So, following Penrose, I want to use it. That means that you have to find consciousness in an answer to Descartes, somehow within quantum mechanics. The way to try to answer Descartes is, that open quantum systems can become classical by losing phase information; it's called decoherence, and they can go back and become quantum again. Let me call that the poised realm. I think it's real; I think it's a new aspect of reality. We filed patents on it, so I must believe in it, because I put money into it. Um, that then raises the question, what's consciousness, okay? And as Chalmers rightly argues, any physical explanation you give for what consciousness is, is inadequate, because you can always say, yeah, but why is it conscious? Okay, and Chalmers is right. So, I'm going to give an answer. I'm subject to Chalmers's criticism. So, is Chalmers, by the way, okay? Um, I'm going to say that, that, I be, I think it's a plausible hypothesis that consciousness is associated with quantum measurement. It does a bunch of interesting things for you. Um, it is testable using fruit flies and selecting for resistance or, or ease of anesthetization. But, but more importantly, a famous problem in neurobiology is called a binding problem, namely, if I see as Crick said, a yellow triangle and a blue square, and they're in anatomically different areas of the brain where processing occurs, how do I get yellow to go with triangle and blue to go with square? Well, says Crick, there's a forty hertz, forty cycle per second oscillation and things that fire together get experienced together. I think that's possible, but it's kind of nonsense. How many relational degrees of freedom do you see in the room? That's a lot to squeeze into different phases of a forty-hertz oscillation. Now, in quantum mechanics, there's entanglement. And that's non-local, EPR correlations that are established experimentally. I want to believe, and I think it's testable, that we can use entanglement between anatomically unconnected synapses or neurotransmitters in synapses, to achieve a unity of consciousness. That gives you a lot. So, what I like about this move that I happen to have made is, I've postulated that you need quantum measurements for consciousness, that it turns out that in order to get the quantum correlations in non-local EPR reactions, or interactions, you also have to have measurement events. That's nice. The same hypothesis explains therefore possibly the unity of consciousness. That may not be an accident. So, I'm inclined to think that's it's not stupid. Do I believe it? Of course not, I mean it's, it's, it's much too speculative at this stage. But I will say that it's the only pattern of thought that I know that simultaneously answers the philosophic problems we've had from, since Descartes, is experimentally

testable, may give us a new stance in neurobiology in which synapses and their molecules are the business end of the brain, and may answer the unity of consciousness.