

BRAIN SCIENCE PODCAST

With Ginger Campbell, MD

Episode #62

An Interview with Dr. Warren Brown, Co-Author of *Did My Neurons Make Me Do It?: Philosophical and Neurobiological Perspectives on Moral Responsibility and Free Will*

Aired October 9, 2009

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INTRODUCTION

Welcome to the *Brain Science Podcast*. I'm your host, Dr. Ginger Campbell. This is Episode 62. Today I have an interview with [Dr. Warren Brown](#), co-author of [*Did My Neurons Make Me Do It?: Philosophical and Neurobiological Perspectives on Moral Responsibility and Free Will*](#). Those of you who are regular listeners may recall that I discussed *Did My Neurons Make Me Do It?* back in [Episode 53](#).

If you visit the [Discussion Forum](#) you also know that the episode generated quite a bit of debate and discussion. I'm glad to finally be able to get Dr. Brown on so we can talk to him about some of the main ideas of his book, and also what he and his co-author, [Nancey Murphy](#), were hoping to accomplish.

But if you are new to the podcast, it is not necessary to listen to Episode 53 first. I would encourage everyone to go back and listen to the episode again, after you listen to Dr. Brown's interview.

I will have links to everything we talk about in the show notes at brainsciencepodcast.com. And, as always, you can send me email at docartemis@gmail.com. After the interview I will be back with a few brief announcements.

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INTERVIEW

Dr. Campbell: Warren, it's great to have you on the *Brain Science Podcast* today.

Dr. Brown: Thank you very much. I appreciate you reviewing our book in your previous podcast.

Dr. Campbell: Well, I'm glad I finally got a chance to talk to you. Could you start out just by telling us a little bit about yourself?

Dr. Brown: Yes. I am a professor in a graduate school of psychology. I teach the neuropsychology part of the program. My academic background is in experimental psychology, and I spent my post doc years at the [UCLA Brain Research Institute](#).

Actually the thing I spend most of my time doing is studying a congenital brain disorder called [agenesis of the corpus callosum](#), which is a disorder where the connections between the right and left cerebral hemispheres don't develop. So, I spend a lot of time with my students studying that.

Dr. Campbell: That must lead to some interesting deficits.

Dr. Brown: It's actually subtle. A big structure is missing, and what happens cognitively and socially is subtle, but consistent, I think. At least, that's what

we're trying to figure out. It's a rather rare disorder, so it hasn't received much attention prior to the last 10, 15, or 20 years that we've been working on it.

Dr. Campbell: Today we're going to talk about your book that you co-wrote with Nancey Murphy, called *Did My Neurons Make Me Do It?* And in that book you mentioned that the book took 10 years to write. Could you talk a little bit about the process of writing that book?

Dr. Brown: Yes, it took 10 years. Having done a previous book called, [*Whatever Happened to the Soul?*](#), one of the sort of solutions to typical mind-body [dualism](#) is an idea of [emergence](#) and non-reductive properties of physical systems. And we kind of had the feeling that, certainly in the philosophical arguments, that term was rather vague and somewhat hand-waving, and so there needed to be some substance given to the idea of emergence and the idea of non-reductive properties.

The reason it took 10 years was we just had to get to talking the same language, in a language that had traction both in philosophy and in neuroscience. That took a long time. We went down some ways that in the end we decided weren't productive—they didn't really help people in neuroscience think about the philosophy, or people in philosophy think about the neuroscience.

Dr. Campbell: Was there a main question that you were trying to answer with the book?

Dr. Brown: How it can be the case that you can have a free moral agent when a system is a physical system—a physical, biological person—and how it can be that a complex system has properties that are properties of the whole person, the whole system, and not just a conglomeration of the properties of the parts: it could be neurons, or it could be molecules, if you like.

Dr. Campbell: In the book it describes you as having a focus on anti-[Cartesianism](#). Do you think that's an accurate description of your position?

Dr. Brown: Yes, I think so, probably. We're more kind of in favor of an [emergentist](#) non-reductive point of view than necessarily against a Cartesian point of view. I once gave a talk in which I, in some sense, defended [Descartes](#) in terms of what was concludable at his time.

And a philosopher came up to me and said it was nice to have somebody say something nice about Descartes. I'm anti-Cartesian mostly since the book. And my position, and Nancey Murphy's position, is anti-dualist with respect to human beings.

Dr. Campbell: OK. So, how did you get interested in this rather philosophical argument—I mean, as a [neuropsychologist](#)?

Dr. Brown: Well, that's a very good question. Partly it was coming to a place like the [Fuller Seminary](#). When you are doing neuroscience work and teaching neuroscience topics, and you're in the context of philosophical and theological training, teaching scholarly work, you're forced into asking yourself questions about things that you might otherwise want to ignore.

And the sort of body-soul, body-mind, body-soul-spirit, or whatever, world view or view of human beings is certainly problematic in neurobiology. And so, you need to think about other ways to think about human persons—particularly when you're teaching in a seminary context.

Dr. Campbell: So, it was really something that was almost a natural outcome of where you were.

Dr. Brown: Yes. I mean it shouldn't be. These are questions that should have been on my mind, I guess, as a neuroscientist at UCLA. But they certainly

become much more immediate in conversations with my colleagues when I'm in a place like Fuller.

Dr. Campbell: For the sake of my listeners that might not have heard Episode 53 or, in particular, haven't had a chance yet to read your book, *Did My Neurons Make Me Do It?*, can you give us a brief overview of your book's main premise?

Dr. Brown: The book's main premise is a philosophical position called [non-reductive physicalism](#)—which is a mouthful, I know. The [physicalism](#) part means that it's really not necessary to add some additional entity—a mind or a soul—to account for human capacities, human distinctiveness, the humanness of persons; that there is sufficient complexity in our physical systems to account for that.

And then the non-reductive part means that there are properties of us as whole persons, as whole physical beings, that cannot be accounted for on the basis of the properties of neurons, or molecules, or atoms: That there are what are called emergent properties, and that those are sufficient to describe and account for our humanness, including things like free will, or moral agencies making moral decisions, being social and moral persons.

Dr. Campbell: Could you say something a little bit more about the difference between reductive and non-reductive physicalism? It seems like most people just assume that physicalism is reductive.

Dr. Brown: Yes. There's a person we talked about a lot in the book, and I actually studied with for years—a British neuroscientist named Donald MacKay, who wrote a lot of books in philosophy of science¹. Some of his books were not philosophical scholarly books, but more popular books.

¹ The key reference cited in Murphy and Brown is *Behind the Eye*, The Gifford Lectures, ed. Valerie MacKay (Oxford: Blackwell, 1991).

He used a term called ‘nothing but,’ by which he meant that it is a false presupposition that a complex system is nothing but the properties of its parts—of atoms and molecules. So, to say that humans are nothing but the properties of atoms and molecules is to be a reductionist. And we don’t believe that is true.

Dr. Campbell: Isn’t it rather unusual for a philosopher and a scientist to write a book together?

Dr. Brown: It has happened before, but it is unusual. What I have seen more of is people—particularly in neuroscience and other forms of science—reaching some state of fame, and therefore writing books that are basically philosophical arguments, but without the benefit of working with a philosopher—which does discipline your thinking, and does discipline your language and your thought process, and also helps you fit your ideas and positions into wider conversations in disciplines other than your own.

So, it was a great experience. And I think we both feel that we came up with something neither of us could have done on our own. Nancey has said that many times, as I have—that this was not a product of either of us alone, or something we would have or could have done by ourselves.

Dr. Campbell: And she sort of passed me on to you, so I’m assuming you’re going to stick up for her, too.

Dr. Brown: Absolutely.

Dr. Campbell: How do you, as a scientist, look at the relationship between science and philosophy?

Dr. Brown: Well, it’s more than just science and philosophy: It’s science and theology, it’s science and subjective experiences of being a person. There are a lot of things to be taken into consideration. And I use the term ‘resonance.’ That is,

philosophy and neurobiology are not (saying)² the exact same things, but what you want is to say things within philosophy and within neuroscience that have resonance in the other domains; that is, they're not conflicting, and they are complementary in some way.

But the language, the methods, the topics, the ways of going about scholarship are different enough in these fields that you can't say exactly the same thing in philosophical language that one would say in biological language or in neuroscience language.

Dr. Campbell: Last year I interviewed [Michael Arbib](#).³ I asked him a similar question, and he said something that it seems like a lot of scientists seem to think, which was that philosophers are good at coming up with questions, but their answers aren't necessarily very tenable. How would you respond to that?

Dr. Brown: Nancey and I would both say that some forms of philosophy—particularly [analytic philosophy](#)—are not a good way to approach these questions: that you really can't get to the answers. You can ask the questions, but you can't answer the questions. So, some forms of philosophy I guess I would agree with that; probably not all forms of philosophy.

Nancey is not an analytic philosopher. Being an analytic philosopher means you're posing pretty abstract questions and using abstract terms that you get sort of married to. You've kind of got to account for this, because you have a word for it that people have been talking about in philosophy.

And those concepts and terms—what we had to struggle with—just don't have much traction in the description of real persons. So, you have to come up with a

² In this transcript words that can not be heard clearly are shown parentheses.

³ Dr. Arbib was interviewed about mirror neurons in [Episode 39](#) of the *Brain Science Podcast*.

different set of terms and a different way of going about philosophy when you really want to work closely with neurobiology.

Dr. Campbell: The reason that I got into this whole area was I was reading [philosophy of mind](#)⁴ and I really thought that the place where philosophy and science come together at this point in history seems to be right here at the intersection between neuroscience and philosophy of mind. And that's what fascinates me.

Dr. Brown: Yes. Just to give you an example, a lot of the conversation we started out with came from my being part of a small group meeting. Mostly I ended up sitting there trying to figure out what was going on. But the direction of the conversation was accounting for what is the relationship between a mental state and a brain state—and this mental state and this brain state, and the next mental state and brain state—in this kind of a linear, how-do-you-account-for-this manner.

And finally I just said, I don't think that kind of structure—even though that's the way philosophy of mind is thought—I don't think you can get there with that formulation. And so, one of the reasons that we came to the idea of focusing on feedback is that it is a non-linear (it's circular) interaction of action in the world and feedback, and evaluation of the action, and then new action and feedback. And then you have this constantly-going loop. And all organisms, all biology is in this sort of continuous feedback relationship with the environment.

And the issue is not what mental state leads to the next mental state, or what brain state leads to the next mental state, but how is this circuit being evaluated, and its outcome. And that's just a completely different starting point. So, we had to come up with a different starting point. And when we came to that starting point we felt like we had made some progress in getting footing to move forward,

⁴ Recommended reading: [Consciousness: An Introduction](#) by Susan Blackmore.

both philosophically and in neurobiology, in describing things in ways that have some traction in neurobiology.

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Dr. Campbell: Warren, let's get into some of the meat of your book. You said in the book at one point that you had to attack (I think you used the word 'attack'; I apologize if that's an exaggeration) two very prevalent world views—causal reductionism and the idea of the mental as inner. Can you address why those would need to be attacked?

Dr. Brown: Causal reductionism just does not work, because it's basically dehumanizing that every causal process is down to the level of atoms and molecules—that humans per se are nothing but vibrating molecules, and all the rules and everything that moves us forward in the world are entirely determined at the level of lower processes, so that causal reductionism means all the causes are down there at these micro levels.

And if you have that, rationality doesn't make any sense, ethics doesn't make any sense, because any ethical thought or rational thought you would have could not be judged by truth or social ethics. It would just be the outcome of things happening at the level of molecules and atoms. So, causal reductionism is just problematic.

And what was the other one?

Dr. Campbell: The idea of mental as being inner.

Dr. Brown: Yes. As soon as you have mental as describing things inside of me, you have lapsed back into (whether you intended to or not) a mind-body or a body-soul sort of dualism, as if there are two things going on—one which is an inner autonomous separate event and one that is an outer bodily event. And so, we just thought that the idea of mental as inner was problematic.

I would say (I don't remember if we said this in the book; we might have) the idea of mind is basically a verb. It's not a noun. And we get ourselves trapped by using 'mind' as a noun. Minding—doing complex sorts of interactions with the world that we call mental—are in fact ways we interact with the world. They're ongoing processes. We don't have 'a' mind. As soon as you have 'a' mind, then you've got to figure out where is the mind, and that's where you get into this problem of the mind being inner.

Dr. Campbell: You use a phrase in the book that's very important—top-down causation. And I know when I was reading the book, my first reaction to that was very negative. I was expecting God around the corner, to be honest with you. But then I read carefully what you wrote, and realized that wasn't what you were talking about. Can you talk about how you use the phrase 'top-down causation'?

Dr. Brown: There are several ways that 'top-down' is rightly used with respect to humankind and us as embodied persons. One is probably better described as sort of levels of complexity: the more complex system as a whole constraining or influencing the less complex parts. It's sort of a part-whole relationship. The whole constrains all the parts.

In that sense we don't mean top-down in the sense of top-down in a company, where the executive is at the top, and the executive sends a command down that

tells some other member of the organization to do X or Y. That would necessitate some kind of an inner agent that was different than the person as a whole. So, part-whole, or the constraint of the smaller parts with respect to a system as a whole, is the best way to understand that part-whole.

Now, there is a form of top-down that kind of works down the nervous system, from the cerebral cortex down through the midbrain, and the brainstem, and the spinal cord. And in that sense there is a sort of a hierarchical top-down. But these levels are so tightly coupled that what happens in the cortex kind of has no existence or meaning without tight coupling with the brainstem, or the midbrain, or the spinal cord.

So, even though you kind of have a hierarchical system in the nervous system, and in that sense some kind of a top-down from the (cerebral cortex)⁵ down, it's much more tightly coupled than having an independent agent, or autonomous agent at the top commanding everything down below it.

Dr. Campbell: Right.

Dr. Brown: So, there are two ways that we would think about top-down, but that second way I'm talking about can be distracting if you don't credit the tight coupling in the entire nervous system, and the nervous system with the entire body.

Dr. Campbell: Yes, if you don't take that into account, the fact that in the sensory system there's like 10 times as much feedback downward as there is feedforward signals wouldn't make any sense at all.

Dr. Brown: Right. That the cerebral cortex, for example, in the visual system sorts visual information. Not everything that comes into the eye gets passed on

⁵ In this case, the words in parenthesis represent a logical guess since there was a dropout in the audio here.

or processed in the cerebral cortex. And attention and other kinds of expectancies have a lot to do with what the visual system processes. But this merely means that they're tightly coupled together. They don't operate independently.

So, it's not like the frontal cortex, for example, is an autonomous agent governing and pulling the strings to what happens in the posterior visual system, but these are just very much integrated into one processing unit. It's just that the things that the frontal cortex, for example, does—at least in terms of informational complexity—kind of operate at a higher level.

Dr. Campbell: It gets back to that whole mental as inner thing again, though, because I think part of that in your book was about the tendency to think of mental as a passive process. And if, for example, our perception of the world was purely a passive process, we wouldn't have all those feedback loops.

Dr. Brown: Exactly. We are not, as you say, passive receivers of information, and then acting on the basis of a calculation of that information. But we first act in the world and then our sensory systems give us feedback from those actions. And the only way we know anything in the world is by actively interacting with the world.

I'll often think of babies. Babies have lots of visual input, but this visual input has no information until they start to act. So, the reason babies pick things up, and put them in their mouth, and manipulate them is to figure out what they are so that the visual information then means something, because it means something in terms of an active interaction and feedback with these things that the baby sees visually.

Dr. Campbell: And we also know from animal experiments that if that interaction doesn't occur, normal vision doesn't develop.

Dr. Brown: Yes. In fact there's a thing you can do with adult human beings. You can give them goggles that reverse the world from left to right. And, of course, when you want something on your right you reach to the left, because visually it looks like it's on the left.

If you have a person live with those for several days, and interact normally with the world, the visual system turns itself around and you're now perceiving things correctly, even though these goggles turn things around. But if you don't let the person interact with the world, and just passively view the world, the visual system never corrects and turns things around.

Dr. Campbell: That's a good example.

Dr. Brown: So, you have to interact.

Dr. Campbell: So, that sort of leads into the next thing I wanted to talk about, which is the problem of replacing mind-body dualism with brain-body dualism.

Dr. Brown: Yes. A lot of the way that we loosely talk about the brain is as if all of mental activity is simply brain processes, and therefore what we used to call the mind is now the brain, but it's in some sense independent of, or sort of residing in this body, and controls it as some kind of an autonomous agent that controls the body that it's nested in.

And one of the ways that I think this gets sort of processed in philosophy is these ideas of a brain in a vat—as if the brain can be separated from the world and be intelligent at all. I just think it's a non sequitur. It's a meaningless mental experiment to think about a brain in a vat, because a brain in a vat without a body just can't have meaningful information to start with.

It can't be intelligent, because we're intelligent because we interact with the world bodily. Our bodies are part of our sensory systems, and part of our emotional

feedbacks, and all kinds of things. We just don't have any information without being able somehow to interact with the world.

And when I think I'm thinking offline (you know, I'm sitting in my chair, I'm really not doing anything here, I'm just sort of thinking about things) I'm basically rehearsing actions in the world from memory. I'm rehearsing conversations, creating possible conversations, imagining possible actions, but all accessed out of memories of real actions in the world in the past.

You mentioned people like [Raymond Gibbs](#). Raymond Gibbs⁶ talks about this a lot. [Andy Clark](#) talks about this a lot⁷—about the degree to which our intelligence is really an embodied intelligence. It's not an abstract thing sitting in the brain—that the brain can be intelligent on its own.

Dr. Campbell: Yes, you had that great quote in the book (and I don't remember who it's from): 'The mind is embodied, not embrained.'⁸

Dr. Brown: Yes. That's a term we have used and others have used. Yes, exactly. And it's not just embodied. Andy Clark really says we're sort of encultured, in the sense that he says we make the world smart so that we can be dumb in peace.

And a lot of our intelligence is scaffolded out in things that we either construct or our culture has constructed for us out in the environment. We, as intelligent beings, are pretty tightly coupled with our social and cultural environment. So, in that sense we're embedded as well as embodied.

⁶ Gibbs, Raymond W. Jr., *Embodiment and Cognitive Science*, 2006.

⁷ Clark's latest book is [Supersizing the Mind: Embodiment, Action, and Cognitive Extension](#).

⁸Paraphrased from Antonio Damasio's book *Descartes' Error: Emotion, Reason, and the Human Brain* (1994), page 118. (quoted on page 25 of *Did My Neurons Make Me Do It?*)

Dr. Campbell: And for some reason people are really threatened by the extent that that's represented by our use of computers, when they don't seem to realize that what we do with computers is just the same things we've always done with the world around us, it's just a different version.

Dr. Brown: Yes.

Dr. Campbell: When I was in medical school we always used to carry all these things in our pockets where we had written down what we were going to do, and we called it our peripheral brain. I think medical students' pockets are a lot lighter now, now that they just have to carry a PDA.

Dr. Brown: Yes. My son and daughter are physicians, and they point out to me how much of medical knowledge is immediately accessible to a physician, beyond their own memories, by what they can bring up quickly on a PDA or on a computer.

Dr. Campbell: Yes. It really does make a difference.

Dr. Brown: So, it has enhanced the cognitive capacities of physicians by providing another memory source—scaffolded memory out there in our computers. Part of it is we just want to think of ourselves as autonomous persons in some way; and to view our embeddedness in cultures, and societies, and cultural artifacts is hard for us to think about when we're so used to thinking about ourselves as entirely autonomous.

[music]

Dr. Campbell: Why is it important for us to consider the person as a whole as an agent, instead of something like some separate thing?

Dr. Brown: There are a lot of things that I think get distorted by thinking of the real person as being somebody or something inside, rather than the whole physical person you're seeing in front of you, for one thing. This idea of the agent inside, I got a sort of revelation, I thought (at least for me), about why this is so compelling.

I was on an airplane listening to some music by to B.B. King and Eric Clapton. And I suddenly realized that B.B. King and Eric Clapton were inescapably in the middle of my head—that when you listen on stereo earphones, you perceive the music as right in the middle of your head.

And when we talk we hear ourselves that same way—that our own voice is sort of inside. And when we think about our talking, I think we have that same impression that this is something that is happening by an inner voice that is inside of me, rather than me as a whole person thinking about me talking, or conversing, or whatever, as something that goes out from me to another person.

So, I think that's why it's so compelling to us. It's hard to think about my thinking without thinking about it as internal—as just inner. But it then leads to thinking about what is thinking—it's merely my brain. And therefore we begin to work ourselves back to, again, other forms of dualism, where we've got an agent inside there that is separate from me as a whole person. I don't think it's a good formulation. I think it makes some part of neurobiology and some part of philosophy difficult to deal with when that is sort of the groundwork.

Dr. Campbell: It's kind of a perceptual distortion that we are naturally prone to, but that is not really productive.

Dr. Brown: Yes. And to think about that, first of all we kind of lapse back into forms of dualism. And those forms of dualism make philosophical progress and theological progress, as far as I'm concerned, difficult in a modern world of

neurobiology, where it's easy to identify the neural systems involved in this, that or the other.

And so, basically our only option becomes either to think of the agent as the whole person and not another agent inside, or to think of the brain as a separate autonomous agent inside the body—which, when you think about it long enough, doesn't make any sense either. So, it's really hard to make understandings in philosophy, theology, subjective experiences of myself as a person, and neurobiology all resonant when you don't start with the whole physical person as the agent as a whole.

Dr. Campbell: That makes sense to me. So, can we talk a little bit about the dynamic systems approach? Because that's a key tool that appears in your book for explaining how we can take this whole approach.

Dr. Brown: [Dynamical systems](#) is a complex theoretical mathematical theory, most of which I don't attempt to try to understand. So, I'm not an expert in dynamical systems from that point of view. But to look at the descriptions of dynamical systems, how they operate and what they are, looks to me like the best description of how emergence could be possible.

How a system that is very complex—has a lot of parts, has a lot of interconnections between those parts—is coupled with an external environment in some feedback way such that it has some capacity to reorganize and adapt to that environment, and also has some way of preserving those reorganizations and reorganizing again later. All of that is, to me, very much like what one would say about a nervous system and about a person.

And so, I just think what I understand as the characteristics of dynamical systems—in terms of how you get from physiology and complexity of physiology to personhood, and thinking, and language, and all of those sorts of things—

dynamical systems looks to me like the best theoretical way to understand emergence in that sense.

Dr. Campbell: So that we can get past emergence as some kind of hand-waving.

Dr. Brown: Yes. That we have a robust theoretical description of how complex systems come to have properties that are causal in the world—that is, that those properties are what interact with the world—but come about by the organization of parts in particular patterns within the complexity that are adaptive and organized in a way to face the environment and to deal with the environment. Dynamical systems don't have to be biological, but I think the best illustration of dynamical systems is biological.

Dr. Campbell: Can you give an example?

Dr. Brown: The example that is used in the book, and by many people who talk this way, is about the relationship between individual ants and ant colonies. And you talked about that in your previous episode. That is, that a colony, once organized, does things in the environment that are not reducible to individual ants.

And different colonies organize in different ways, depending on the demands of the environment that that colony finds itself in. And that is preserved, even though most of the ants change over over the years. That organization—that property—stays true of that ant colony, even though individual ants change over.

Another way that's kind of similar is how do you get to an episodic memory—that is, a memory of an actual event in the past—from a bunch of neurons and synapses? Neurons and synapses organize in some way to code and therefore preserve a memory, but that memory is not a property of any particular neuron. So, you can lose neurons and not lose the memory or any particular synapse.

But it's a property network that comes into play at the event, and because of the (malleability)⁹ and plasticity of the synaptic system, has a way of being recreated in neural events sometime later, such as to be able to remember some event in the past. And so, it's a dynamical system in the sense that it is complex, and its description as a system is a way it's organized to represent something or meet something within the environment.

Dr. Campbell: I'm going to just kind of review this for the sake of my listeners. You're using dynamical systems as a theoretical framework for emergence, right?

Dr. Brown: Yes.

Dr. Campbell: What are the key properties or key features of emergence? I just want to make sure that we emphasize this by repeating it.

Dr. Brown: I think the key features of dynamical systems, which to me suggest that this theoretical structure tells us something about emergence of causal properties in (biological systems?) like human beings is that, first of all, they are complex, have lots of elements, and lots of connectivity between those elements—much like our nervous systems—that they organize themselves with experience.

And we talked about the fact that even babies don't know anything until they interact. And then as they interact with an environment, the system organizes itself, such as to meet that environmental event and preserve it in some way over time, such that when these events occur in the future, they're already there within the system that meets that demand—that allows us to become organisms, not just a bunch of molecules or cells.

⁹ Phrases that are unclear in the original audio are shown in parentheses.

Dr. Campbell: We see, then, that at the higher level we're going to see properties that we couldn't just get from the laws pertaining to the parts, but no laws of the physical universe have to be broken.

[music]

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Dr. Campbell: Before we close I do want to talk a little bit more about this idea of downward, or top-down, causation because it's so important to us being able to really be causal agents in the world and not just epiphenomena, so to speak. Can you talk a little bit about the principles of downward causation in more detail than we did before?

Dr. Brown: Let me use my memory example. A particular neuron is representing my memory of an event that happened last night. So, I'm thinking here, and I remember I had a conversation last night with my wife. So, how do I remember that?

Well, a whole lot of neurons get involved. First of all the memory itself is not any particular neuron, it's the pattern of neurons. And any particular neuron in that network or pattern, its activity is constrained as the memory is represented in time, by its interaction with all the other cells around it that are involved in that network.

So, the properties of individual neuron activity don't get superseded—they merely get constrained by that neuron being in a larger network. But that larger network is causal in the sense that it is a representation of a memory, it does allow or embody a memory that I can use to react, or act, or make decisions.

So, the network itself is causal. The network itself constrains, in a sort of downward way, the neuron, and by constraining the neuron, also constrains the membrane potentials and the molecules that are in the neuron, by its current engagement in that network.

So, top-down is a matter of constraints of the current activity and the immediate future of a particular element in the network by the activity of the whole network. And then the whole network is the thing that is significantly causal in the world—allows me to have a memory.

Dr. Campbell: OK. So, final big question: How do we get from these dynamical systems to intelligent action?

Dr. Brown: In dynamical systems they talk about these self-organizing systems, dynamical systems, organized in a certain way. This is with respect to pressure from the environment in which it is sort of out of balance with the environment. It reorganizes in such a way to meet that environmental challenge and has that as a part of its organization that can be used in the future. If that can be used in the future, then they talk about that as 'meaning', in the sense that it's meaning its adaptive relationship to the environment.

So, if we are complex self-organizing systems, our organization, going through time, and child development, and adolescent and adult experiences, those organizations are preserved in ways that preserve meaning—and meaning in the sense of our relationship as a system to the environments which we are in.

So, in dynamical systems terms they do use the term ‘meaning’ as a term that is descriptive of the organization of a system in its relationship with the environment that it exists in. That’s kind of a low-level description. I hate even to have this conversation about human agency without including language, because language becomes emergent in so many important ways.

So, one of the things that we organize—in respect to culturally—is the use of language in the populations we inhabit. The use of language has properties that are organized within us, but allow us to meet the environment in certain ways by using language. We could go on, and on, and on when you start talking about the nature of intelligence and language.

Dr. Campbell: Yes, because you spend a good amount of time in the book talking about [Terrence Deacon’s](#) work on emergence as it relates to language¹⁰. I think you even went so far as to say that in order to really have a responsible agent we would need language.

Dr. Brown: I would say not a responsible agent. I think agents in some sense are responsible in the sense that they organize in ways that respond to the environment, and the environment has contingencies that one in some sense is responsible for. I think to have a morally responsible agent –

Dr. Campbell: OK, morally responsible.

¹⁰ Recommended reading: [The Symbolic Species: The Co-Evolution of Language and the Brain](#) by Terrence W. Deacon

Dr. Brown: – you need some kind of a way to represent moral relationships, which probably at least need minimal language—like the ability to represent the future and past in some way, and ideas of good and bad, and ideas of human and non-human—coded in ways that you can build into a moral way of thinking. So, I would say, probably a morally responsible agent would demand some representational symbolic system.

Dr. Campbell: I think you also emphasized the importance of (and you've been talking about this) memory, because otherwise we wouldn't be able to evaluate our own actions and judge them as being right or wrong.

Dr. Brown: Yes. Memory allows you to bring back into consideration of a current event, events teaching ideas from the past. But memory is not something that obviously is in any way unique or distinctive to human beings, and therefore to human moral behavior, and moral responsibility, and moral agency. I mean rats have great memories.

Still, in cognitive psychology, as I understand it, it's up in the air as to the richness of an event memory of a rat, or even a chimpanzee or monkey. We may in fact have richer event memories that also allow us to be more deeply social and more deeply moral as persons.

I think our humanness emerges from the interaction of very high level things that are not necessarily unique, but fairly distinctively more complex in human beings—such as language. You could argue that some amount of language has been demonstrated in chimpanzees, but it's hugely more developed in humans.

A theory of mind—that is, the ability to understand the mental life of other persons—event memory is arguably more complex and rich in humans. Our social responsiveness, particularly emotional attunement, is arguably richer. And so, it's not any one of these things, but it is all of these things together, that allow

us to be in some sense uniquely or distinctively human in ways that are not possible by even an intelligent chimp.

Dr. Campbell: But there's nothing about the things that make us able to be moral agents that can't be described by our neurobiology.

Dr. Brown: No. I think it's all nested in complex biology—which is amazing to think about. I think that's what neuroscience is telling us.

Dr. Campbell: Me, too. So, is there anything else you'd like to add before we close?

Dr. Brown: I don't think so. I think part of what we're getting at is almost a change in a world view. I read recently an account of [Isaac Newton](#), who was dealing with the issue of instantaneous change, which is in some sense nonsensical. Nothing changes without taking some amount of time. At least it didn't seem to make any sense.

And he said, well, let's assume it to be true, and if you assume it to be true, see where you get. And where you got was the [calculus](#). And so, all of the calculus we use was based on assumption. So, you sort of change your basic assumptions and you open up a whole world.

Well, somebody in the past made the assumption (or the assumption was made generally) that all causes can be understood by something smaller—something that is a part of this; that the parts cause the whole. And that's very productive. Physics has moved forward very productively by that.

But I think there is now a need for another assumption that it's not just the parts, but it's the organization of the parts, that new causes emerge. And if we take that assumption and begin to look where it takes us, I think it allows us to understand

rich aspects of human nature and the emergence of that human nature from our biology.

Dr. Campbell: Was there anything in my coverage of your book that you felt needed to be corrected?

Dr. Brown: Oh, just little things. Whether Fuller is a liberal seminary or not depends on who you talk to. Mainline seminaries think we're conservative, and the very conservative seminaries think we're real liberal. So, it all depends on who you talk to.

No, there's nothing in there particularly. I thought you did a very nice job of representing what it was we were trying to say. And I appreciate, again, very much you being interested in our book.

Dr. Campbell: Thank you. Would you be wanting to hear from any listeners? Would you like to get emails, or would you just like me to indirectly let you know what kind of feedback we get?

Dr. Brown: I would rather that be indirect. I mean I'd love to do it in one sense, if I had the time, but I just don't have the time.

Dr. Campbell: I'm not sure exactly when I'm going to post this. It's probably going to be in October. I've got an interview¹¹ that I did for my other show with [Tom Clark](#), who also reviewed your book on his website. And I was going to put his episode out, and then yours, because I think they complement each other.

Dr. Brown: Tom makes theological jumps out of this that I wouldn't make, obviously. But I think we're pretty much in agreement about the nature of humankind and the nature of emergence as a natural process.

¹¹ [Episode 30](#) of *Books and Ideas* is an interview with Tom Clark, author of *Encountering Naturalism: A Worldview and Its Uses*.

Dr. Campbell: I got all this flack about people saying, ‘Oh, they’re just trying to sneak God in.’ And I asked Tom about it, and he said, ‘Well, I didn’t see the word “God” anywhere in that book.’

Dr. Brown: The word ‘God’ appears in one footnote in which we say that this does not prejudice theology one way or the other.

Dr. Campbell: Right.

Dr. Brown: We were definitely not wanting to write a theology book, or even a book that is nested in theological discourse. This was about philosophy and neuroscience, and about the nature of mind and human responsibility. That’s all we were trying to take on. I mean, obviously, theologically, if you don’t have a morally responsible person you don’t have much traction theologically. But that wasn’t our point.

Dr. Campbell: Jumping to that conclusion is like when atheists get mad when someone ignores them just because they’re an atheist. I think this is the other side of that same human tendency.

Dr. Brown: Exactly.

Dr. Campbell: If you have a chance, tell Nancey that I used her great letter¹² that she had in [Science](#) magazine a few months ago. I’ve been using that. I’m trying to make people more aware of that issue, because I think it’s a really important one. In fact, that’s one of the reasons why I was so motivated to cover your book, because I just think it’s really an important issue. But, I’ll send you links when the episode does come out.

¹² "Neuroscience and the Soul," letter in *Science* 2/27/09 Vol. 323, page 1168 (available on-line to AAAS members)

Dr. Brown: There's one other thing you might say in your webcast. Up until a month ago our book was only available in about a \$70 hardback. It is now available in a \$20 paperback.

Dr. Campbell: Well, good. I'll change the link on my website to the \$20 version.

Dr. Brown: Good. Do so.

Dr. Campbell: Thanks again. I really appreciate you taking the time to talk.

Dr. Brown: It was great to talk to you. I appreciate you being interested in the book.

[music]

I want to thank Dr. Brown for coming on the *Brain Science Podcast*, and I want to remind you that you will find the links and references for this episode at brainsciencepodcast.com. If you aren't already subscribed to my other podcast, *Books and Ideas*, you will find the interview with Tom Clark that we talked about at booksandideas.com and in iTunes.

And, of course, don't forget to tell everyone about both of these podcasts. And try to remember to leave reviews in iTunes, because that helps our ratings.

Next month's episode will be an interview with [David Bainbridge](#), from Cambridge. Dr. Bainbridge wrote the wonderful book, [Beyond the Zonules of Zinn](#), which I discussed back in [Episode 32](#). We will be talking about his new book, [Teenagers: A Natural History](#), and we will be focusing on the teenage brain.

Until then, don't forget to join our new [Facebook Fan Page](#). The best way to find it is to go to Facebook and to search for 'brain science podcast.' I'm hoping that when we hit 1000 members we'll be able to get a web address that will be short enough to remember.

You can also follow me on Twitter, where I am [Doc Artemis](#). And, of course, you can send me email at docartemis@gmail.com. Be sure to put 'brain science podcast' in the subject line. I read all emails, although I'm finding that it's becoming increasingly difficult to answer them all.

What about the winner of this month's book drawing? Well, I have chosen a winner, and the winner is going to be getting to choose between the new, [The Sharp Brains Guide to Brain Fitness](#), and the book, [Fixing My Gaze: A Scientist's Journey into Seeing in Three Dimensions](#), by Susan R. Barry.

I always like to email the winner ahead of time—I make sure that they don't have a problem with me saying their name on the air—and I haven't heard back yet from this month's winner. So, just look in your emails and make sure that you aren't the winner.

And don't forget that, even if you don't make a contribution to the *Brain Science Podcast*, you can enter the book drawing by sending me an email that has 'brain science podcast book drawing' in the subject line. My email is docartemis@gmail.com.

Thanks again for listening. I look forward to talking with you again next month.

[music]

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Transcribed by [Lori Wolfson](#)

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