SCIENCE OF THE NOOSPHERE

Michael Jacob

with

David Sloan Wilson

David Sloan Wilson: Okay. Michael, so happy to have this conversation with you about brains and societies. Please tell us a little about yourself as a human being, and how you wandered into this particular line of work.

Michael Jacob: Yeah. Well, thank you very much, David. I'm very happy to be here and in conversation with you, and had a chance to see some of these other interviews. It's very exciting to be a part of this project. Yeah. Me as a human being, certainly a good place for us to start thinking about relationships. I'm a father of two. I have two small children. Married to my wife. We live with our family here in San Francisco, California.

Gosh. Let's see. I guess, being a father and let's just say that's fairly central to my identity. But as a human being, I think of myself strongly as a scientist, and as a psychiatrist. I suspect that's probably what we'll end up talking about today.

DSW: Thank you, Michael. Just a little bit more about your academic background, what was your major in college? How did you develop an interest in brain processes and that kind of thing?

MJ: My interest in the brain probably goes all the way back to high school, really. In some sort of strange turn of events, I ended up in an introductory program for high school students who want to get exposure to the sciences. I had really hoped to get into a wet lab and do molecular biology. Strangely enough, I ended up in a plant lab, and was very disappointed when I found out that I ended up in a plant lab.

As it turned out, I ended up working with a molecular biologist who studied plants, but also studied myelin sheath, which is the membrane that surrounds neurons. She was really interested in lipid biology, and also had an interest in plant lipid formation, and the use of plants as medicines. One thing led to the next and so I became really, really interested in this question of what the heck is the brain? How does this work?

I came to college with an interest—I went to UC Berkeley, and wanted to study the brain. There was no question for me about that. I just wasn't sure exactly how to do it. Again, looking for research opportunities as an undergraduate was lucky enough to end up working in the lab of Ralph Freeman at UC Berkeley and optometry. This is a very basic visuals, neuroscience processing lab, and had my first exposure to something called single neuron recordings.

The basic biology or experimental paradigm, you may be familiar with, where you place this electrode into the brain of an organism that you might be studying, and you present a stimulus or something on the screen, and measure the neural activity that responds to what was presented to the organism. This process to me was immediately alive, immediately dynamic. Just completely was enamored with this process that we could, in real time, watch biology play out and a biology that was eminently experiential.

I mean, you see something on a screen, and you see it as a human being. You know it's there. Then the organism, you see the neurons sending off their spikes in response. This experience had me hooked and I continued to do this type of work as a graduate student and where I was at the University of Rochester ...

DSW: That was my alma mater too, that’s where I got my undergraduate degree.

MJ: Wonderful. Yes. I noticed that in your biography. I know now that you're still in New York. I think very fondly of upstate. But one of the things that I guess really struck me about being able to record from these neurons was how idiosyncratic the whole process was. Sometimes you'd go in and you'd record some neurons, and you just get a stream of activity when you present a stimulus. Maybe you'd come back, you present the same stimulus, and you'd see nothing.

And I was just really wondering, what's going on here? What is it about the variability in this system? What is the complexity of what's going on? Is there something about our experimental paradigm? That's a question I've been struggling with that one for a long time. Around the same time, I was at University of Rochester and simultaneously pursuing a medical degree, which turns out to be quite an endeavor.

Don't necessarily highly recommend medicine and try to do both at the same time. But for me this was part of what I was failing to get from the neuroscience side, which was human experience, just as we're engaging conversation right now. I want to actually know what's on the minds of the organisms, of the people that I'm working with. I want to try and make their lives better.

I think that, although I didn't realize it then, it's pretty clear that I was going to head toward psychiatry as a career, and really wrestle with both improving our science, from the neuroscience of psychiatry, but also improving it, particularly because of the importance of human relationship and working towards healing others in those relationships.

DSW: That's great, Michael. Thank you so much. Of course, this is among the most technically challenging of any topic that you take, what an organism does on the outside, and then understand how that's actually accomplished mechanistically on the inside. When you look at something like those single neuron recordings, and you realize that one neuron is part of a network of how many millions of neurons and we need to understand their interactions and all that.

It's amazing that we've made as much progress as we have. Let's spend a little bit of time on that. I'm a little bit familiar with this kind of research. For example, on the outside, the organism makes a decision, it does this, not that. On the inside, what's happened is some competition among neurons, different categories of neurons are firing at different rates. As soon as one category receives a threshold, then something else happens.

Then that leads to the behavioral event. There's a distributed process taking place on the inside. In fact, I think it's safe to say everything that takes place on the inside is a distributed process. What else could it be? Yet it leads to sensible behavior. In other words, functionally sensible behavior on the outside. That's my account. But you're the expert. Maybe you could cover that ground in a little bit more detail.

Talk about an experiment or something, which maps a sensible behavior on the outside to the mechanistic process on the inside.

MJ: Right. Right. No small task here. I think that there's the level of scale. Yeah. I think one of the distinctions that we might want to make in our conversation is the differences in terms of thinking about measurements from single neurons or one neuron at a time, populations of neurons. Then of course, measuring from an entire brain as one might accomplish using something like functional magnetic resonance imaging or these brain scans.

But just following what you're asking, I get the sense. This is about what's going on at the level of this single neuron level and those spiking activity? Is that my understanding correctly?

DSW: Yeah. Or any other way you want to take this conversation.

MJ: Maybe I'll illustrate it in terms of how I stumbled across this in experimentally, which is there's a region in the brain, the human brain, part of parietal cortex. It's similar in the monkey brain, where I did most of my research as a graduate student. I think when most neuroscientists at least over the past 10,

20 years, ask about decision making, usually what people are thinking about are interactions between these neurons in parietal cortex and neurons in frontal cortex, sort of frontal parietal interactions.

The reason why we narrow in on these particular neurons is that when you record from neurons in lateral, inter-parietal region, say, in a monkey, and the monkey needs to make a very simple decision, say, turn a knob left or turn a knob right, in order to earn a reward in a particular task. What you see is this build up in activity in single neurons. Then of course, as your average across a population of neurons, you see this buildup of activity.

You can find a lot of remarkable ... There's a lot of remarkable information that's contained in that build up. There may be the time at which that build up peaks corresponds with the time that the monkey needs to make the decision. Or the magnitude, the strength of that activity might correspond with that degree of certainty that the animal may have about the situation. Am I sure I need to go left or do I need to go right, especially under more ambiguous situations where it's maybe not entirely clear.

But this is some of the anatomical focus studies that are done in decision making. But then there's, of course, I think what you're also getting to, which is there's a distributive process here. That build up of activity may actually reflect an integration from, well, the other additional information that is coming into the organism. We may be listening to one part of the brain, but of course, the whole other rest of the brain is still active.

Visual information, for example, or perhaps information from memory. As that activity builds, it's integrating across. This is one of the, like you said, reaching a threshold, that threshold to bound decision making hypotheses.

DSW: Now what I'd like to do is I'd like to make the jump from an individual brain to a society. But before getting to human society, I want to visit insect societies. In particular, some work that I know well by Tom Seeley. I don't know if you're familiar with his work on honeybee colonies. He has two books. One is called The Wisdom of the Hive, which gives you a flavor of what he's getting at.

Then a second book called Honeybee Democracy. What he shows very clearly is that the process of social decision making in a honeybee colony is very much the interactions among neurons within an individual brain. The comparison between a social brain and an individual brain is a very strong comparison in this case. One of the things he studies is how the swarm basically when a hive gets too big, it splits.

Then one half of the colony goes and they form a big cluster in a tree and then scouts go out, and they investigate different cavities. They have to make a decision as to the best cavity to go into. It turns out that they can do this with considerable sophistication. Tom has shown that. They examine the cavities who have six or seven different factors in mind. All of this gets reported back by the scout bees. They come back.

On the surface of the swarm, they dance and the famous bee dance, which indicates the location, in this case, of the cavity. But the quality of the cavity is represented by the length of the dance, by the length of the dance. Then other bees are observing the dances and they actually don't make a decision themselves. They actually pick a dancer at random, and then they go to check out that particular cavity.

But because the best cavities result in the longest dances, that results in a statistical bias. That gradually, the number of bees that are dancing on behalf of the best cavity increases and increases. When it passes the threshold, then a decision gets made. And the whole process gets initiated in which the swarm takes off and flies to the best cavity. My God. I mean, if that's not amazing, what would be?

Tom has worked that out and just amazing detail. In his article, he compares it to some of the research on rhesus monkeys. It might even be your work for all I know. I don't remember the authors in which the monkeys have been trained to look at a screen and there's a number of dots moving to the left, or

moving to the right. The monkeys have been rewarded for turning their head in the direction that most of the dots are moving.

Then with these single neuron recordings, they're recording basically single neurons that fire when they see a dot moving to the right or fire with a dot moving to the left. That same kind of buildup, leading to the monkey turning its head is what takes place. So there's a mechanistic process among the neurons that is literally much like the social interactions among the bees. The intelligence of the hive in making this decision has been demonstrated just as well as the intelligence of the monkey turning in the direction that gets it a reward.

So when it comes to comparing a single brain with a social process, that's as good as it get. That's as good as it gets. The idea of a society having everything that we associate with a mind is secure, at least in that comparison between an organism with its brain, multicellular organism and its brain, and a social insect colony. Could you comment on any of that? I don't know if you're familiar with that research or not.

But any of that before I move on, make my next move here, which will be towards human society?

MJ: It is interesting just to hear ... if I understood correctly, the initial impetus for this was that the hive got too big. Is that the idea and they're separating, and they need to find a new home?

DSW: That's part of the lifecycle of a beehive. Yeah.

MJ: Yeah. It's part of the lifecycle, right, which is interesting in and of itself. That it's a fission process. But in any case, the decision making element of this... Truth be told, I'm not an expert in decision making. I don't have a lot of deep knowledge about it. But I do have some experience having done those sorts of experiments.

I think there's clearly going to be some differences. I don't know about the functional specialization of insects and how they come together. One of the things that I guess I would emphasize in the, especially in the rhesus monkey work is that the experimental paradigms themselves are highly constrained. In real life, there's rarely a situation where there's a one and done decision.

Clearly, those do exist. One of the things that's really was interesting to me is that in those perceptual decision making tasks, the dots are going left, the dots are going right, very similar sort of things. The neurons would make this decision about which way ... Or the monkey would make a decision, and of course, the neurons would show corresponding activity. But then, immediately after making that decision, the neurons would show a very different pattern of behavior that often needed to reflect the larger context in which the decision needed to be made. Such that if you, say, you're just turning left or turning right on the basis of the dots, what if then you actually have to navigate around in your world to find out where to go. This is one of the distinctions, is that what was just immediately a particular decision now, as the context changes, it's just a radically different decision making environment.

I hesitate to use the word information, because that could set us down a whole other rabbit hole. But there's a certain kind of information processing that's happening here in terms of those dynamics, and the timescale over which that decision making is happening in larger context of the organism. I think there's some fairness in the analogy that's drawn to the beehive. But I'm not sure how far I can stretch it.

DSW: That's a fair point. I don't think anyone does in the absence of research. More often than not, we end up being surprised. We have underestimated the abilities of the organism or the social insect colony in this case. Also, I mean, it's amazing, all of this is in the context of learned activities. These are not genetically evolved adaptations. These are associations and what we do on the basis of associations that have just been learned over relatively short time period. And still, they're so sophisticated that not only do you learn to turn your head, for example, but you might also have to then learn how to actually act upon that in some complicated way based on barriers and obstacles. Yes, you can do that, too. And yet

that has a mechanistic basis that will take us years and decades to unravel, even though we do it, obviously, every day of our lives.

MJ: If I might just jump in for one second. In that sense, I might almost give the beehive a lot more credit in this analogy, which is to say that in the rhesus monkey experiments, these are highly over-learned paradigms. The monkeys figured it all out extremely well, and are highly habituated to what's going on. Whereas in the case of the beehive decision making, I mean, they're headed out to the great unknown. I mean, they don't know where they're going to put their hive.

I think that there's probably even more credit is due to the beehive in this case, perhaps, I'm not sure. But just to underscore the importance of the habit and learning versus truly novel situations is a very different brain dynamics. We don't see the same over-learned buildup of activity when you just have no idea what you're going to do.

DSW: So now, we've already consolidated the comparison between an individual multicellular organism and a society, in this case, the social insect society. Now let's make the jump to human society. But before we get to large scale human society, let's make a stop at small scale human society. Here, what I want to say, what I want to assert, and then I'll justify it is that connection is about as good as the connection with a social insect colony.

Based on other conversations in this series, and based on the best of our current knowledge, what we can say is that the genetic evolution of our species is like the evolution of the ultra social insects. We are, in a sense, an ultra social primate species. The small human group, the size of a hunter gatherer group is, in fact, a cooperative unit, a highly cooperative unit. Of course, that cooperation must have a mental dimension, a mechanistic dimension.

It's actually not farfetched, not science fiction to actually look for and expect social interaction among individuals in a small group that are trying to do something like hunt, or gather or especially to make a decision. That is a bit like the individual brain and the honeybee colony. The conversation that's most directly related to that, in this series, is with Garriy Shteynberg and Jim Coan.

Jim is a clinical neuroscientist, I think, pretty close to what you do, Michael, at the University of Virginia. Are you familiar with Jim's work and his holding hands paradigm? Okay. Well, let me briefly describe it. In fact, I won't describe it in too much detail.

Actually one point I want to make is that intellectually, we are in a period of history that's dominated by individualism. In other words, the expectation that the fundamental unit is the individual organism, that everything social can be described in terms of the thoughts and actions of individuals. The idea of society as an organism in its own right, or group as an organism in its own right, well, once common, if you go back a century, or into the 19th century, you'll find that it was actually the dominant idea has, for the last 70 years been almost totally eclipsed by the idea that it’s the individual that’s the self-contained cognitive unit.

It's the individual that perceives, the individual that remembers, the individual that makes decisions, and the idea that all of these things could actually be group processes, fundamentally group processes that take place in smaller groups of people that live with each other and do things together is new and amazing against the background of individualism, even though it has long roots in the social sciences.

It's against that background that the work of Jim and Garriy are reviving that and thinking about all aspects of human cognition, memory is a great example. I mean, so much of what you need to remember is not in your head. It's in the heads of other people around you. Thankfully you know who they are. That's the way memory always has been, has evolved. There's one.

In Jim's experiments, basically, put people under stress, experimentally, within an FMRI machine, under threat of electric shock. Then doing that under three conditions—alone, holding the hands of a stranger,

or holding the hand of a loved one. Holding the hand of a loved one has this tremendous calming effect. Why? Because that the brain is acting upon based on the sensory information of holding hand is that it has social support in addition to personal resources, social resources, in addition to personal resources.

The way that Jim puts it, because we've always lived in cooperative groups, never alone, always in the context of cooperative groups, our brains and bodies evolved to integrate our personal resources and our social resources at all times, obviously usually subconsciously. When you remove social resources, and a person is alone, and therefore only has access to personal resources, the brain and body interprets that as an emergency situation, as an emergency situation.

Anyhow, that's the flavor of what Jim and Garriy do. Against that background, I'd like to have you talk a little bit about the way that you think about the social human brain, the human social brain in the context of small groups, which is I would say the natural human social environment. Then we're going to take a big jump to large scale human society.

But first, let's make a stop here at the scale of small group, the natural human social environment where we call the environment of evolutionary adaptiveness for our species.

MJ: I have come across that work before. One of my colleagues at University of California, UCSF, Josh Woolley, runs a lab called the bonding ... They call themselves the BAND lab, I think it's like bonding and something emotional attunement, something to that effect.

There's just a huge area of study with respect to social neuroscience. What I love about the experiment that you're articulating from James Coan is that it just emphasizes the effect to which individualism has permeated our experimental paradigms. We were talking about weaknesses of experimental paradigms earlier with regards to rhesus monkeys. You're studying one monkey at a time. Here, we're just studying one human brain.

We put them in the brain scanner. Not only that, we put you in this room. You're shut off from people around you. I don't know if you've had an MRI done. But I've had my fair share, mostly for research. You go into this room. You have to lie down. You're in the dark and you're in a tunnel. These are the things that I think we fail to appreciate. I think just that alone is going to cause stress.

I don't remember the exact stress paradigm that was used. My own experience of being in the brain scanner, there's these goggles that you get to wear, because you're lying flat. You're just looking up and you're seeing that you're in the tunnel. It's a little anxiety provoking claustrophobia. There's this mirror that allows you to look down so that you can see through your feet and to the command module.

When you look into the command module ...

DSW: And now, act natural.

MJ: Act natural. What really struck me about this experience was how comforted I felt when I was able to actually see my colleagues through the window and know that they were there, that I was not alone stuck in this machine. Even our experimental paradigms themselves already set this up. Yes. This is a whole field of social neuroscience.

I think that now we're finally beginning to maybe, excuse me, put people in the same room and use maybe two EEG machines or two EEG caps so that we can see not only how we're synchronizing our behavior and communication, but also neural activity become synchronized also on that basis. Skipping over all the details of what is meant by that synchronization process. But what I really like about this idea is it's drawing attention to the fact that we're by definition in relationship.

That's where we started our conversation. You want to know who I am as a human being. I want to know who you are as a human being. Our relationships that we have and I think part of your question was also

about our close knit relationships, our family units, perhaps, or extended family, those sorts of connections.

I mean, we are not individuals in the sense that we think we are. Everywhere we go, we carry the memories of our fathers and our mothers and our ancestors in us.

All those patterns of behavior, the other's mind, wait a minute, is our mind just acting like my father was back when he faced the same situation. There's that way in which the memory gets carried forward in us. Even though we perceive it, we have the sense of some of agency around it as if this is this is me. That may be one of the areas that causes challenges for people, was when we tend to over identify or misattribute certain aspects of our personality, and take over ownership of them, perhaps unnecessarily.

MJ: Well, that may have taken us a little bit off the track of where we're going.

DSW: Not at all, Michael. Absolutely. In fact, just the opposite, because what you pointed to is the idea that cultures being transgenerational really must be considered some kind of organism in their own right, which is, of course, what Teilhard was all about. Cultures do adapt members of the culture to their environment. They're often very sophisticated. I mean, I've spent my life studying such things as religious belief systems. Just like an organism, a religious belief system basically prepares members of the church, members of the community to make the right moves, to do the right things at the right time, behave this way towards that category of people, that way towards another category of people. They're adaptive at the group level. You can show it. And somehow it replicates itself.

As the individuals, the members of the culture come and go, the cultures replicates themselves. Young people assimilate the culture, so on and so forth, and it evolves and so on and so forth. The idea that cultural entities are a life form, and that we have to attribute an anatomy and physiology, and some kind of nervous system to them, is implicit in what it means for a culture to be adaptive, once again, by a process of selection. This doesn't just self organize. I think that leads me to my next major point.

But I want to consolidate something here, too. Insofar as we can say that for a large culture, a large scale culture, not just a smaller group, then we've advanced our thinking from the multicellular organism is an organism, it's the quintessential organism. Social insect colony is an organism. A small human group can be an organism. And danged if a large human cultural system can also qualify as an organism.

Okay. Now, in all of those cases, those entities are units of selection. I mean, clearly the multicellular organism and its brain and everything else about it is a product of eons of selection at the individual level. Actually, natural selection has been winnowing functional organization for endless generations. Same is true with social insect colonies. Colonies, at any particular generation, they vary in how well they function and only the ones that function best are the ones that make it to the next generation.

So too for small human groups. So too for larger human cultures by a process of cultural evolution. The message here is that functional organization, what qualifies an entity as an organism with a brain requires a process of selection. When that process of selection doesn't happen, doesn't exist, then what do you have? You have an entity, which is very complex, very interconnected, but does not qualify as an organism that doesn't do sensible things. That doesn't make the right moves.

The most important question, I think, both for basic understanding, and also moving into the future, if we want the noosphere to be any kind of global cooperation, we need to select it as such. It's not going to just emerge. The ability to recognize functional organization where it exists, and also to recognize where it doesn't exist, and to have the tools to do that—at the individual level, compare a healthy organism with a sick organism; or an organism with a brain that's functioning as it should, and a brain that's had a stroke, or somehow impaired, the methods have to be able to detect that.

What I find is that often people are thinking about this, they don't make that clear distinction. They focus on such things as, let us say, interdependence, extreme interdependence as this implies some kind

of functional organization. They think that something like a noosphere can evolve in entities when they're in fact not being selected. We shouldn't expect it. We shouldn't. I wonder what you think about all of this, and then we can pursue it in a number of ways.

But actually, let me make one final comparison just to nail it down, in part because this is the subject of some of my other conversations, between a so-called Smart City and another kind of city. So if you look at cities as a unit, what you find is, they're all complicated. They're all interconnected. They've all got traffic, for example, to focus on a specific example.

But whether that traffic flows smoothly, as opposed to getting all tangled up in traffic jams all the time. Most of the time, the traffic doesn't function smoothly. If you want it to function smoothly, you better select the street plan and the stoplights and all that. You're going to have to actually do work in order to get a city to function adaptively. Let's say with respect to traffic. It's not going to self organize. It never will.

Work is required. Then we need to be able to actually identify that kind of variation, something working well as a system versus something not working well as a system. Realizing that in all cases, there'll be very complex relationships, there'll be a great deal of interdependence. But that's not the deciding factor. That's not what we need to know to distinguish function from dysfunction.

I've said a lot. Now please respond. Then we can get to some of your specific examples, because you have fascinating examples of decisions, societal decisions having to do with such things as Black Lives Matter and racial equity and things like that. I'm eager to get to your own work along those lines on social processes against this background, this stage that I'm trying to set.

MJ: I appreciate the background and the stage. I think you're right. We need to have some clarity around what that is, especially since I really appreciate and very fundamentally agree with this idea that self organization and complexity, interconnectivity, is not enough. It's probably an understatement, frankly.

It's actually, it was a major interest of mine when I was an undergraduate was to just go to the library and find as many books I could find on complex adaptive systems and see how these things are mapping out, cellular automata, chaos, complexity theory, just really exciting. I think just beautiful work, in some sense. I'm getting a few different threads from what you're saying.

One is the question of complexity, and interwoven in all of this, of course, is the unit of selection and evolution. But another piece here is that the question of normativity. So, what's good, what's bad? It's a distinctly biological question. I mean, but that isn't really built in, at least from my opinion, I don't think, within the fabric of evolution or of biology.

Certain species, for example, may go extinct. I mean, is this good, is this bad from the perspective of the species in competition? Of course, it's a travesty, I think, as a human being and a member of a community when our actions lead to dramatic loss of biodiversity, for example. What is it about humanity, human beings? We start to ask these questions about what's good and bad.

Whereas I don't know that other animals ask the questions in the same way and have the reflection on it that we do. I guess I think that that's really particularly relevant because of the idea of this beehive and the swarm. Clearly, there's collective intelligence. Would we call it collective mind? Is there a distinction between those two? That could be a question that might be worth examining.

Or a smart city, for example. What makes the city smart? A city free of traffic, or a city that's jam packed, having lots of traffic, but maybe comes alive in other ways. I'm not sure. There's an interesting terrain there that where we start to make some ... we raise questions of value, which I think are great.

I think we should raise those questions, but to wonder a little bit more deeply about it on that level. Maybe that's a little bit of my background of how I come to some of these questions.

DSW: There's no way to get around ethical questions, the idea that science or especially economics can be value free. In economics, they make a distinction between what they call positive and normative economics. Normative is we have values. We're trying to achieve those values.

Positive is just describing economic systems the way they are. And orthodox economic theory pretends that let's just stick to positive economics. Let's not go to normative. But really, the new paradigm of economics…you can't do that. Everything we do is value laden. Unless we actually have goals, normative goals, in other words, in plain English, unless we decide what we need to do, what should we do as a group, let it be by consensus. What do we want? Not what do you want or what do you make me do. What do we want and work towards . Then things are not going to turn out right. And yes it's a very complicated world. There's indirect effects, there's unforeseen consequences. It's multidimensional. It's all of these things. But nevertheless, if we don't actually deliberately make goals, and aim for something as a target of selection, and then steer towards it, then cultural evolution will take place, but it will not lead to global solutions.

That's what takes place in nature more often than not. Every species is evolving. Every species has its adaptive strategy. The aggregate result of that is not an organism. It's not. I mean, laissez-faire doesn't work any better in nature than it does in human life.

The only biological units that function well are the ones that have been selected as units. That includes such things as microbiome, very large ecosystems of microbes function well for their hosts, because they've been surviving and reproducing along with their host. Functional organization exists in nature. Sometimes at very large scale, such as the microbiome, trillions of organisms, thousands of species, but only because that process of selection has been operating, or at least that's what I would say.

Against that background, let's talk a little bit about the work that you've done on decision making at this large scale and such things such basically topical issues, such as racial equity, the civil rights movement. Talk to us about how you've been monitoring that based on ... in some way that's roughly similar to what you do with individual brains.

MJ: Yeah. This was really our initial project, or foray into this area. I should say, it's really ... I can't take credit for the entirety of this work. There's a team of us.

DSW: Oh, yeah. Who's the team? List the members of your team. Who's on the team?

MJ: Yeah. There's Parham Pourdavood, who you may have come across with Human Energy. He's done some work with the website among other things. He's a cognitive data scientist from UC Berkeley, just graduated as an undergrad, just earned his undergraduate degree this past spring. He does a lot of our analysis. But is also intimately involved in the theoretical discussions.

Along with Parham, you may have come across, I think you know Boris Shoshitaishvili who ... There's my best attempt at his last name. Hopefully I got that one.

DSW: Congratulations. I'm glad that you said it, not me.

MJ: Boris has been working with us. The other is Frederick Steele, who is a Jungian analyst in San Francisco, who's been a mentor of mine for a long time.

Our longstanding project has been to make psychotherapy, psychodynamic, psychotherapies in particular to reintegrate those theories with neuroscience. It's mostly just a freewheeling theoretical exploration.

But once he heard about this project, he seemed a natural fit to continue that conversation, a whole team of us. Really, I should say that we didn't set out. This was not a very goal directed project, speaking of goals, in the sense that we really had no idea where we're going. Really to us is the question of the analogy. Does this fit?

DSW: That's the random component of a cultural evolutionary process.

MJ: We were just interested in this question of the analogy. I mean, can we even think of society in the same ways that we think about brains? But also motivated by Yuval Harari's question about our society and algorithm. Are human beings, neurons or microchips? Do we just sort of all come together and process information?

That was a little bit in the background for us was, are individual members of society like neurons? That's how we ended up with decision making, since it was of global interest to the group. Then the question is, with what we already talked about with decision making in the brain, we know there's some dynamics in there, but where would we begin with society? What level does society make a decision?

Does it make a decision when to enter a war, for example, or to close the borders or to pass a law? Are these the decisions that society is making? Those are the most observable decisions, I suppose, on some level. I think at the time we were motivated by current events. We were in the pandemic and thinking about those events, but also about the different members of our society.

Here in the midst of this pandemic, we had this outpouring of protest, of shifting in consciousness, I think, and a lot of conversations about questions of racial equity. There's a lot that was on our minds about that. I think one of the things that we were wondering is, why is this happening now?

In part, I think it's fair to say a mistaken view that, well, once we pass the laws, then the decision is made, and then everything is solved. Which, obviously, that's just not the case. I mean, we could say everybody's equal and clearly everybody's not. One way of trying to get at this question of change in societal view, societal perspective, was to actually look at public opinion data.

I think that's one of the challenges in exploring this analogy is that we could just talk about it. That's one thing. But is there any data? Is there anything that we can get our hands on to apply the same methods we might, or at least roughly apply the methods we might use in neuroscience to see how society functions? There's not a lot of continuous data. This is really sort of a modern thing that we collect the amount of information that we do.

One thing we're really wondering is, do people express opinions like a neuron does? We talked earlier about the neuron that is responding to a decision, particular decision. What we also talked a little bit about the context and how that can change the activity. What's really dramatic about this is that, for a long time, neuroscientists thought that you'd study from one neuron, say, a neuron that responded to going left, leftward moving dots, and always showed some activity when you were going left, but never showed activity when the dots were going the other direction. For a long time neuroscientists really thought that these preferences, they call them preferences, or cell activities were really hardwired in or at least soft-wired in enough that they didn't really change much.

One of the things we've learned over the past 10, 20 years in neuroscience is that remarkably, even in more primary visual areas, you can see some dramatic changes in neuronal cell activity, both in the context of a particular task, or over time. This phenomena is called representational drift. This degree of plasticity, one, to me, made the argument that neurons are microchips, are logical operators...it challenges that, it makes it a little bit less tenable that they're not operating on a logical circuit level, and can show changes not particularly reliable.

What might happen at the level of society, do we see those sorts of shifts in opinion? Of course, we do. We do know that you and I can change our opinions. We can make new decisions that we didn't make yesterday about the future.

We looked at public opinion polling over time. One of the things we found is that around the passage, I think it was the passage of the 1964 Civil Rights Act. Prior to that, most Americans who were polled felt actually that blacks were treated pretty fairly. Something like 60%, 70% of society thought that everything was fair.

Then right around the time of the Civil Rights Act, there's a little uptick. All of a sudden, okay, some people start to think maybe they're not treated so fairly, maybe there's some racism in our society or that they're not treated fairly. So that public opinion poll changes. But then immediately after the passage of the Act, it drops right back down again. Majority of society says, "Okay. We're equal now. We passed the Civil Rights Act and public opinion."

We didn't see changes in that public opinion poll until really the 21st century. Up until the 21st century, finally crossed the threshold where more than half the population is starting to say, "Okay. There's inequality, there's inequity." This is a pretty remarkable finding.

But it reminded me, and this is all kind of analogy. I mean, this is speculative. But it reminded me of certain aspects of decision making dynamics in the brain, which is to say that there's that initial decision that needed to be made. Are we going left or are we going right? But it's not a decision that we make once. It's a decision that we need to make continuously, and we need to continue to reevaluate.

There are other neurons that continue to report about the status of the experiment, the status of what's going on. Those neurons seem to show a very different timescale in their build up of activity. This is where we started to draw some analogy between decision making…while it is a study of decision making, in some sense, I think, actually really more fundamentally a study of changes in perspective, changes in information processing, and the dynamics of those changes in information processing.

Really wanting to highlight that aspect of the brain and how it works, that doesn't really operate like a computer does.

DSW: Yeah. I think this is great, Michael. I think that if I were to design a research program around this, here's how I would do it. It could be done at a number of scalesI. It could be done at a small scale, or a large scale. The first thing is to be able to identify how well a group is functioning as a group, as a cooperative units in outside terms, phenotypic term before we look on the inside.

That's quite easy to do. There are some groups, for example, in which the members of the group that clearly regard themselves as members of a group that have a common objective. What are we going to do? There might be differences of opinion and their decision making process. But at the same time, at some time it's understood that we need to make a decision, and even if I don't disagree, then we'll go ahead with it, all of this kind of thing, which we can recognize and measure. It's not just a matter of opinion. This is a group that's capable of making good decisions. That happens at any scale, including the national scale. One of the conversations in this series is with the Daron Acemoglu, who wrote the book Why Nations Fail, which is a comparison of nations as basically whether they work well or poorly.

That mapped onto whether they're inclusive or extractive. Compare a despotic society with a democratic inclusive society, and you will see these differences. Compare, for example, a society that's in a civil war, or close to a civil war, a society whose numbers are actually are set against each other. They don't regard themselves as a member of the same nation, for example. They're simply trying to get their way.

When they succeed, then that's, for a while, but the other side hasn't changed their mind. They're just waiting for their next opportunity and so on. That's clearly a conflict situation. You wouldn't say that that's a group that's actually trying to make a collective decision. You can determine all of that on the outside basically. Phenotypically, you can determine whether if society is functioning well or poor as a collective unit.

Then look on the inside, and then do these studies and see what's happening with the individuals and the sharing and so on and so forth. I think that would be really exciting. In order to make that distinction on a functional basis, and then look on the inside. But has that happened? Is that part of the research program? I mean, is that basically what you have in mind, you and your colleagues have in mind? I'm curious.

MJ: Yeah. I think how I'm understanding a little bit of what you're asking here. I think there's, initially, an effort here, which is to say, "Okay. Is this analogy hold that society works like a brain? Should we just apply the tools of neuroscience?" I think probably where, perhaps I suspect we're in some agreement, that if we just apply these tools that measure things like complexity or connectedness or even statistical measures of things, it's really only one perspective of what's going on.

The way that I phrased this in our approaches is the mixture of quantitative and qualitative methodologies. The kind of thing that I would really love to do, which is to have high quality quantitative and high quality qualitative data about what people are experiencing with respect to what's going on in these group phenomena. What is the diversity of opinions?

To me, why that is so important is that it goes back to some of the motivation here in the first place is that, you know a neuron is sending a signal. But what the heck is that signal about? When you and I are in communication, what is it that we're talking about? What's the meaning of the information that we're sharing with each other?

I think that, obviously, has profound causal effects on the world. We look at the content of the information that's going around right now, there's a real diversity, some of which I would venture to say is fairly maladaptive for our country, and especially with respect to what you're suggesting in terms of conflict, and even war, the idea of a civil war, things like this. You could be really well connected up, and that could be the information that's reverberating through your network.

There's this meaning and there's the significance of it. Even if it's well organized, perhaps, I'm not sure. It's the marriage of those two approaches. I think that the quantitative level gives us a better picture of some of the dynamics. It's hard to capture that, if we're just talking to one person at a time.

DSW: Yeah. We have to appreciate the extreme challenges, methodological challenges which exist at the social level, in addition to the neuronal level. In one of your studies that I read, you're trying to infer causation from correlation. You have this data set, its time series analysis, longitudinal data, and stuff like that. Of course, there's many, many things that are correlated.

But what you're trying to tease apart is what's causal. What sense is something causing something else within a very, very complex system based on the data that you have available? There's huge algorithms that are required in order to do that. But if you succeed, even if you succeed, all you succeeded in showing ... I'm not discouraging this at all, is A caused B. We don't know the good effect or bad effects.

Really, working out a causal answer is only partway towards a functional answer. Was A causing B is good effect or bad effect? That's how complicated it is. On the one hand, just to work out the causal structure, what's causing what in a complex system? It's hard enough. Then to work out, to be able to understand that in any kind of functional terms is different.

I won't say harder still, because I think It is possible to do it, but it's just different. So if some of the things I'm saying sound critical, I hope they don't, frankly. This is what we need to do, difficult work. But anyhow, this is all great, Michael. I think this has been a wonderful conversation. I think I've had my say. Is there anything else you'd like to add before we bring this to a close?

MJ: That's a good question. I mean, I certainly have some questions for you at some point. We can decide whether we want to have another conversation another time to go into. But on this particular issue here of causality, I think part of what motivates this, I think, at least for us, is that one of the things about science, and exploring complex systems is that we're finding things that are unexpected or things that are clearly hard to predict.

I think that's part of the motivation is it's like, "Okay. Well, where should we be looking next? What kind of things are going on?" Once we get that perspective, then we can say, "Okay. Now we drill down." We

talked briefly about relationships. I mean, people may have a dynamic in a relationship, or in a family or in a culture. We can maybe get the sense that there's this something there.

First, we need that sense that there's something there, then we can start to drill down and wonder more about what's the meaning of that. It's by going between those levels that I think yield fruitful scientific process.

DSW: Yeah. I agree completely. I mean, it's an early stage of discovery, basically. Discovery stage where more or less you're saying, "What's going on here?" But the fact that you need such technology in order to ask simple question is, what makes it challenging? But we are at that stage. Therefore, that's a fine question to ask guided by theory as much as possible.

I also want to say that this project of the Human Energy Project, bringing together the scientists and sponsoring our research and basically addressing these questions is a great thing. I'm grateful for the support of Human Energy to be able to have these conversations and to focus the research and so on and so forth. I think it's identifying a set of questions, which have not been ... I mean, of course, they've been asked in some ways, but to create the focus and to bring it together. It ties everything, this whole arc from the origin of life, all the way up to the prospect of global cooperation and everything in between, multicellular organisms, social insect colonies, small human groups, large human groups to tie all that together in a conceptually coherent bundle is no small feat in its own right.

Thank you so much for taking part and we will be interacting again, or at least we can moving forward, because we're part of a community that's been assembled by this kind of inquiry.

MJ: Wonderful. Yes. Well, thank you very much. It's been really enjoyable conversation. I too, would just, of course, echo that I think that what the Human Energy Project, I think is allowing for me and in my research that I think is relevant to add here in our closing is that there's the story element of it. We're weaving together multiple disciplines.

It's not merely the sense that we're just going off on a scientific expedition to understand a particular phenomenon. But we're wondering about the meaning of that phenomena to us and our fellow human beings on this process.

DSW: That story needs to be told at several levels. I mean, what we're doing is a start at a very high level. I mean, not everyone is going to be able to follow this conversation and the other conversations in the Science of the Noosphere section. These are deep dives. But they're also deep dives in a way that at that level, at that very high, professional level, it is a form of storytelling that is bringing people together from quite different disciplines.

They're not all on the same page. I regard this conversation as a form of storytelling, which goes alongside another level of storytelling that reaches a much wider audience, and so on and so forth. The idea that there needs to the levels of storytelling, levels of narrative, and a theory is nothing more than a narrative that's highly accountable to science.