Active Inference GuestStream 049.1

“Clickbait, consciousness science, and responsible journalism”

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00:07 Daniel Friedman: Hello and welcome. It's July 26, 2023. We're here in Active Inference Livestream 49.1 with Megan Peters and Nora Bradford. So thank you both for joining. We're looking forward to a presentation followed by a discussion on clickbait, consciousness science, and responsible journalism. So, Megan, to you.

00:32 Megan Peters: Thank you. And thanks so much, Daniel, for having us. We're really happy to be here and to chat about this. So I'll talk for a little over ten minutes and then we'll hopefully have a nice discussion here. So, yeah, we're really happy to be here because I think that this is a really topical thing for us to be talking about right now. It's very in the media. It's really in response to the way the media has been covering consciousness science just in the past few weeks. So here we go. I'll have a few things to share with you.

Okay, so since we're talking about consciousness science, let's start with a provocative question. So you are conscious. How is this possible? How is it possible that your brain creates the conscious experience of you?

And so this is a captivating, and it's a stimulating kind of crazy question. It's a really huge question. It borders on the religious and spiritual in many ways. It borders on the cutting edge of physics in many ways. And so the study of this question and the field of consciousness science more generally, it's really straddling the border between the natural sciences and philosophy and spirituality in a way that a lot of other domains maybe don't need to do. And so, as a result, this field of consciousness science, it really captures the hearts and minds and sometimes pretty wild imaginations of all sorts of folks, as I said, from psychologists and biologists and neuroscientists all the way to computer scientists and engineers to religious and spiritual leaders. Basically anybody who wonders about our origins or place in the universe, why that we know that we are here, why there is something that it is like to be us. They are the people who are interested in this question, and that's probably a lot of people who are listening and watching right now. So it's actually really quite easy, I think, to get swept up in the sensational nature of this question. Consciousness science is a really big deal. It touches on so many aspects of our everyday experience.

And so this kind of leads us to another version of this question, which is, is this even really science? Is this something that can be even studied scientifically? Or does it transcend beyond scientific inquiry? Do consciousness scientists do something that can be characterized really as science? Or maybe they're studying something that's a little bit more on the border, like, I don't know, telepathy or panpsychism, like maybe rocks and trees are also conscious. Wouldn't that be crazy? Or maybe the vibrations of the universe mean that the universe is conscious. So it kind of quickly starts to feel a little

fuzzy, a little less scientific. And that's what I want to talk about today, is that perception and how that is kind of exacerbated by the way that this field is portrayed in the media and maybe what we can do about it.

And so all this means that consciousness science is really difficult, not just to do scientifically, and it is really difficult, I promise you, but it's also really difficult from a social perspective. So more than for some other fields, those of us who do consciousness science and who study this scientifically, we have a really crucial and difficult responsibility, which is to accurately and precisely communicate the state of our field and its methods and its discoveries and how it relates to other fields, from physics to medicine and beyond. And it's in fact, so difficult that our field has actually written a number of papers about just how difficult it is. So this is a fairly recent paper from Matthias Michel and colleagues, including myself and many others. This is just from a few years ago. And these papers, and this one in particular, really highlight why our field in specific has kind of an uphill battle compared to a lot of other areas of study, especially when it comes to potential misrepresentation in the media. So I thought that maybe in order to drive this point home, I could actually give you some examples of how consciousness science has been misrepresented in the media so that we can get a handle on this, we can see it concretely. And as I'm giving you some of these examples, I want you to try to imagine how it would sound if the same kinds of statements, the same kind of sweeping claims were made about discoveries in biology or chemistry, neuroscience, climate science, engineering, that kind of thing. All right, let's do some examples.

Here is the first one. Okay, this is an example which is actually 13 years old at this point. As I think you'll see, maybe it hasn't gotten so much better over the past 13 years. But in this example, the title "Sizing of Consciousness by its bits", we have Christof Koch, who is an expert on consciousness science at Caltech, being quoted as saying, "I love his ideas. It's the only real promising fundamental theory of consciousness". And here the journalist decided to present just this one scientist's opinion as fact without challenging it at all, without presenting any other opinions at all. And I'll point out that this opinion was actually not representative of the consensus in the field at that time. It was this one scientist's point of view, and it's not actually representative of the consensus in the field now either. And so I want you to take this quote, but I want you to replace consciousness with curing cancer. So this opinion presented as fact is akin to writing that one scientist’s

theory about a cure for cancer is the only really promising fundamental theory for curing cancer. And without presenting any other possibilities that maybe more work needs to be done or more experiments need to be run. This is really hyperbolic. And it seems like maybe this kind of hyperbole would be hopefully at least a little less likely to happen in biomedicine, or at least would receive more pushback if it were presented this way.

So here's another example, and this one's a bit more recent. So this one's from 2018. The title is, "Sedate a plant, and it seems to lose consciousness. Is it conscious?" And here's a quote: Okay, so "the electrical activity that moves across neurons is sought by some scientists to contribute to human consciousness." This is like a perfectly reasonable statement, right? Like totally fine, totally legit. But then the the journalist goes on to say, "if electrical activity is being disrupted by anesthetic and plants too, causing them to 'lose consciousness', does that mean in some way that they are conscious?" Okay, so first of all, these statements are pretty vague. That's not really super surprising from a popular science piece. And it's not really the primary problem here, saying that electricity that moves across neurons is thought to contribute to consciousness. But it is an astonishing leap from disruption of electrical activity to plants being conscious. And this is pretty sensational, kind of to the extreme. And it makes this fuzzy border between consciousness science and pseudoscience, which is this border that we are trying so hard to delineate all the time. It makes it even fuzzier. It gives us an even harder problem to fight against as consciousness scientists. And this isn't just happening 13 years ago, five years ago, it's still happening. It's still why we're talking. Just last month, there was this public event which was held in conjunction with the association for the Association Scientific Study of Consciousness annual meeting, which was in New York City. And at this public event, Christof Koch, who you can see here on the right, and Dave Chalmers here on the left, they presented their 25 year old bet about whether the neural correlates of consciousness, the ones that go up and down when consciousness goes up and down, would be found by now, 25 years later. And during this public event, some new results were unveiled for the very first time from one of the ongoing projects, which was designed to challenge two of the many theories about how consciousness arises in the brain. And those two theories are called the Global Neuronal Workspace Theory and the Integrated Information Theory. And the hot off the press results that were shown in this event, they actually ended up challenging both theories. They showed that the

neural correlates of consciousness are still unknown, that neither theory was really strongly supported by the data that were collected, and so on. But that's not the story -- that's not exciting -- and so that's not the story that the press told.

And so here is what the media actually said. Okay, so first we're going to start with Nature. Nature, the journalism side of this flagship scientific journal. You'd hope that they would be pretty careful about their scientific journalism, but instead they write taglines like this, like "Christof wagered Dave, 25 years ago that researchers would learn how the brain achieves consciousness by now, but the quest continues". But this is actually not what the bet was about. The bet was about the neural correlates, not the causal mechanisms, not the generative production of consciousness. And remember as good scientists we are careful to note that correlation and causation are not the same thing. Correlation is not causation. And there's always a relevant XKCD [comic]. And so I direct you to this one here, but it gets worse. So here's what Science -- Science -- had to say. "Advocates of the losing idea are not conceding yet." So again, neither idea lost, remember? Or rather both of them lost. Neither one of them won. Nobody lost. Nobody won. And so why would Science say that one of them lost or is even losing? That seems a little over the top. And so it kind of makes you wonder, are they like trying to drive clicks? Or what is the point here of sensationalizing quite to this degree? It seems like a bad idea. It seems like oversimplification that actually changes the meaning of what was presented.

So here's another example. This is from The Economist. This article largely reported on a different event that was actually part of the ASSC primary meeting. But it still capitalized on the buzz that this public event, this evening event created. And it opens with this really kind of terrible twist of the actual experimental design. So The Economist article says "top of the bill was the announcement of the result of a so called adversarial collaboration between proponents of two hypotheses about the nature of consciousness." Again, not what the bet was about. It wasn't about the nature of consciousness. But anyway, "this involved running a series of experiments, begun in 2020, to determine which, if either of them is correct." But again, that's not what the collaboration was designed to do, right? In science, you can never prove anything. You can never show you're correct. You can only show that you are not wrong or that you are wrong. That's it. That's what you get in science. Okay.

So moreover, all of these articles, the three that I've shown you and a number of others, they also contained essentially no discussion of whether these two theories -- Global Neuronal Workspace Theory and Integrated Information Theory, one of which was losing, apparently -- whether they were the only ones worth considering. So the articles didn't really discuss anything else, any other possible theories. In fact, the articles called these two theories "leading" by the media. But the truth is that they're leading only in number of publications, not in amount of scientific evidence supporting them. They just have a lot of publications out there. There's no discussion in these articles beyond a trivial passing mention that there are any other theories out there at all. And especially that whether they are viable or not, whether they're empirically supported.

So here's some [showing image on slide]. This isn't all of the empirically supported theories of consciousness out there. There's a really nice article here by Anil Seth and Tim Bain that came out last year that discusses a bunch of these. And there's a really nice article here by this group also saying they actually looked at the empirical support for different theories of consciousness. How many papers are out there that actually challenge versus support each theory? And so this landscape is the one that should be the one to evaluate all of the results that were presented at this event in. It means that even if one of the two theories that this one project was looking at, if one of them didn't make the cut, that doesn't mean the other one wins, and is right. It just means that one of them maybe lost. And it didn't even lose, remember?

So in addition to these really nice papers, there's also a whole series of these adversarial collaborations from the same funding agency as the one that was shown in this public event that are designed to actually pit these theories against each other in a pairwise fashion, in a Thunderdome style. For all you Mad Max fans out there, I love old school Sci-Fi. And the idea here is that two theories enter and one theory leaves. One theory survives, but it doesn't win because there's another round coming. And so all of these nuances, they were just unfortunately missing from all the news coverage. And I understand that news likes to get people to read it and it likes to be sensational, but the missing aspects, the missing nuance, really changes the meaning of what was presented. And that's actually a really big problem here. And why is this such a problem, you might ask? I'm getting myself all worked up here, right? So the answer to why I'm getting all worked up really comes back to what I presented in the beginning, which is that we consciousness scientists have this uphill battle we constantly have to fight to

legitimize our research program. And importantly, this isn't just in the eyes of the public. So it's not just in the eyes of the people reading these articles who are not part of this scientific sphere. It's also in the eyes of the scientific community, more generally, of our funding agencies, and maybe most importantly, our close peers within adjacent fields. So imagine for a second that you are on a hiring committee at a university and you read a candidate's description of their research program and it is about consciousness science. They have pages and pages and several publications, and they maybe have a grant that's about consciousness science. But you, as the member of the hiring committee, just read this, this New York Times article about how plants probably have consciousness. And so maybe your eyes are now rolling out of your head because you've been primed to think this isn't real, this is sensational, this isn't something that can be studied scientifically. You might as well be talking about doing research on telepathy. Is this really a colleague that you want?

So here's another example. What if you're on a grant review committee or you're reviewing a paper and you just read these articles in Science and in Nature that heavily imply that there are only two real theories of consciousness that have any empirical support. But the paper or grant that you're reviewing is not targeting either one of these theories. So now maybe you see the problem here. These journalism articles, they're not just infuriating. They're really actively damaging the legitimacy of our field. They're cutting us off at the knees in the eyes of our peers in terms of the financial support we can compete for from granting agencies, in terms of where we can publish our science. And by the way, that science is state of the art and cutting edge.

We have a responsibility, though, as people who are doing this state of the art consciousness science to try to work with the media so that the reporting can be more honest, so we can continue working there as well. This is a two way street in some ways. But we also hope that folks who are listening right now will recognize this pattern the next time you read an article about consciousness science that maybe those sensationalized claims are not exactly a reflection of the state of art in the field. Because here is the truth. This is real consciousness science, modern consciousness science. It's a collection of basically every single state of the art discipline and method of scientific inquiry that you can think of. [showing image of "cognitive sciences", "computational neuroscience", and "compter science/AI/ML" in overlapping Venn diagram]. So my version of consciousness science that I do in my lab is a conglomeration of cognitive

sciences and computational neuroscience and a little bit of computer science, artificial intelligence, machine learning thrown in. We also have heavy influences from philosophy and psychology and engineering and a little bit of metascience, and we have neuroimaging, and we have statistics. [Adding in arrows to the image with all named fields here]. And this is really a representation of consciousness science, not just in my research group, but the consciousness science being done worldwide by thousands of people. Consciousness science is right at the center, right at the heart, the very bleeding edge of our collective scientific understanding.

So remember when I put this slide up before ["You are conscious. How?"] and I said that the study of this question straddles the border between natural sciences and philosophy in a way that a lot of other domains maybe don't need to do. And as a result, it captures our imagination. It gets out there, it gets into your brain and your mind and sticks there in a way that some other fields might not. But maybe you can see through what I've talked about today that the challenges with communicating the crux of this question and in doing the science itself, that actually makes the people who are doing this pretty brave, especially the younger trainees. When you think about it, they're fighting this real uphill battle. So, personally, me, I'm relatively safe. I have job security. If people don't take me seriously when I say I'm a consciousness scientist, that's their loss, that's fine. But the younger people, the trainees in the field, those who are trying to get jobs, those who are trying to push the envelope of what we know about our brains and our minds and our awareness of ourselves in this world, they've got a lot of misperceptions to overcome.

So if you are excited and you want to know more about the modern, exciting field of consciousness science, I suggest that you head to the ASSC website. You can have a look at the whole science program. They've actually posted videos of the keynotes from this year, so that's pretty cool. You can go and see some of those. You can also check out the plan for the future. And of course, if I've inspired you even a little bit to find out about consciousness science yourself -- despite my kind of rant here -- I say welcome. Please come join us. There's a lot of people doing some really cool stuff, really amazing, mind blowing stuff, working to figure this out. So please come join us. Absolutely, the more the merrier. And so I think I will stop there and just say if you've enjoyed this talk or anything that I said resonated with you, I've got a real short little piece here. It's about 800 words, so not a long homework assignment. You can go and check that out. So I

think I'll stop and pass the mic back to Daniel. And also welcome Nora Bradford, who is a doctoral student here at UC Irvine, who works in consciousness science, but who also is an accomplished science journalist who's written articles in Scientific American, Science News, Discover, and many more. So thanks very much.

19:44 Daniel: Nora, maybe to you for a first reflection about what you see there, or how you came to be here.

19:51 Nora Bradford: Yeah, sure. Yeah. So I was at ASSC and went to the event that was associated with ASSC, but not run by ASSC, just to be clear. And it was really exciting to see consciousness science kind of being celebrated in the way that it was. I had some issues with the event, but overall I was very excited that it was getting this public attention. Right. And then afterwards, I was again excited to see that people were writing about my field, because that hasn't happened [?] journalism [?] I'm immediately disappointed by [?] wrong. And I guess I started to think about kind of why consciousness science is maybe a harder area for a journalist to cover. And I think there is just probably a lot more controversy and a lot more room for mistakes to be made than perhaps in fields where the research is more clear cut or more easily interpretable. So, yeah, I think there's a lot as journalists, and also as researchers, from this.

21:03 Megan: Can I just really quickly follow up and say I think that, Nora, you're spot on by saying that, by presenting the idea that it's the interpretation that's part of the problem here. It's not just that people are maybe getting facts wrong when they're writing about this field. It's that the interpretations are really nuanced, they're really difficult to get right, and it's really easy for an oversimplification to end up fundamentally changing the meaning in this space in a way that maybe doesn't occur quite as often in some other fields.

21:38 Daniel: Yeah, that's really interesting to kind of disentangle the features that make this a unique, although also exemplary case, of communicating challenging ideas. I mean, the first that presents itself to me is just how much is on the table. Whose pain matters? Whose experiences or what experiences even matter? What's the difference between a who and a what? This is the real question. If something doesn't have an experience, then there's no feeling. But if something does have an experience, then it's a feeling and it's a morally culpable [thing], or something that we're responsible for

treating in an ethical way. So it's like whether or not it's always brought up in those articles, the stakes are so high, whereas whether a given molecular compound does this molecular interaction, is closer to the objective. Whereas this is the ultimate subjective question, seemingly.

22:43 Megan: Sure, yeah, I agree with you definitely that the ethical stakes, the moral implications of this field are just staggering. And certainly it's not unique in that way that the ethical and moral implications of sociological research or of climate science or of many other domains also have these staggering implications. I think one of the biggest challenges that we have is not just in the interpretation of objective data, but exactly, as you've just said, that this is the ultimate subjectivity, that the thing that we are studying by its definition is not objectively observable. And that is absolutely something that is -- at least you can design measurement tools in a way that have different philosophical foundations in basically every other field. But by its very nature, by the definition of subjective experience, we cannot design a measurement tool that actually says, what is it like to be you? That's kind of the whole problem.

But your points also about the ethical implications in medicine, the difference between a who and a what. I think that that's also really important to bring up, that here we are trying to -- I've presented this as like we want to understand consciousness. And I never really defined consciousness. I just said, like, here's consciousness and here's an umbrella term and you take that kind of how you want. But it's true that consciousness science spans all the way from wakefulness versus coma, or locked in syndrome, or traumatic brain injury, anesthesia, all the way through to is a baby conscious? Is a fetus conscious? Is an AI conscious? Is a cockroach or your dog, or 200 years ago, people might argue that children were less conscious than adults and so it was okay to hit your children because they wouldn't feel it as much, or something. And so there's a lot of sociological and ethical and moral implication in everything that we're doing. Which is why -- one of the reasons I've chosen this field, too, is that it really scratches a lot of intellectual itch. But it also feels really important, especially right now, with the rise of machine intelligence and with ongoing debates about animal or fetal consciousness that really bear extreme impact on legislation, on moral decisions that we make as a people. So, yeah, it's a big thing that we're doing. I'm a little biased, but it is a big thing.

25:28 Nora: And I would add that even if researchers are sometimes good at explaining what they mean by consciousness in their research, like to a journalist, say, the journalists are not always necessarily great at communicating that to the public through their writing. And I get why that would be hard. It can be clunky, it can be awkward and unappealing to explain. But that is crucial because people readers can take it however they want based on how they're interpreting the word "consciousness". So I think that's super important to address if you're writing about consciousness.

26:04 Daniel: Yeah, it's really a field that's kind of a leading indicator because, especially if approached in a scientific way, in our current setting, a scientific understanding of X is what shapes evidence driven policy about X. So I guess this leads to what is or would or could be a science-driven approach. Like, how do we know it when we see it? When someone is approaching this question from a scientific perspective, what would each of you say to this?

26:43 Megan: Well, I'm going to give kind of the stock answer, which is that you want to have objective measures that are valid and reliable, but the big one is falsifiability and that's any student of science going back to grade school is going to learn a little bit about that, which is that: if you've got a theory or you've got a hypothesis about how, let's say, the brain generates consciousness -- or even going back to just correlates, just like, which bits of the brain are correlated in their activity with whether you're more conscious or less conscious. So let's keep it really very basic. You need to have it be falsifiable. You need to say it's this area of the brain that will correlate and not that area of the brain. And the recognition that an absence of evidence is not evidence of absence is also really crucial to this idea, which is that just because I failed to measure a correspondence between the activity and the bit of the brain, that I hypothesized and some measure of awareness that I get from self report, doesn't mean that that area of the brain isn't doing the work. It just means that our machines are terrible or that our measure sucks.

And honestly, despite the state of the art measurements that we do have, we have millimeter level precision in humans, we have cellular level precision in non-human animals, we can record a lot of stuff, and we have a lot of really fancy machine learning algorithms to help us extract what that stuff means. To go from super high dimensional noisy data, down to something that we can maybe make the argument is interpretable.

But just because you didn't find what you were looking for doesn't mean that it's not there. It just means that you were maybe looking in the wrong place or that you were looking using the wrong tool. And so these kind of go hand in hand because on the one hand, you want your hypothesis to be falsifiable, so you aren't allowed to just say, "oh, well, I just wasn't looking for it the right way, so I'm just going to revise how I'm looking and try again. And therefore I'm still right." You need to design your experiments and your theories such that if you find a particular result, a positive result, then it actually disproves your theory, as opposed to just failing to provide support for your theory. So I think that those and other kind of standard criteria that you might find in any STEM classroom that demonstrate the scientific method, those are probably the definitions that I would fall back on. And I think that consciousness science, broadly speaking, the stuff that is presented at the ASSC, it does all of that, it absolutely does. It's the same caliber of computational neuroscience and neuroimaging and psychological, psychophysics measurement, and logical philosophy approaches that you would find at any other flagship conference in the world. Yeah.

29:51 Nora: And I would say if you're reading an article, rather than like a journal paper, like if you're reading something in the press: the way to know if it's trustworthy or not, or one way is if it's making sensational claims, like claiming to have found the root of consciousness, or some really large claim... It's probably not true.

I think that wouldn't happen in one study, I'm assuming. So just read with a skeptical eye and if you feel comfortable, try to read the primary literature, like get inspired by the press. But if you feel like there's something off, just go to the primary literature and see what's up and see if you can interpret it for yourself. It's understandable if you can't, but yeah, that's what I would say.

30:40 Megan: That's a good rule of thumb, Nora, that one study is never going to be the answer in any field not just ours, but it's easy to get swept away in the sensational claims and to be like, "OOH, they found the neural cause of consciousness", probably not.

30:58 Nora: Yeah, yeah. And I would say like pre-registration also. I mean, Megan, I don't know what your rule of thumb is for this, but if people, you know, plan for the study and how they're going to analyze it ahead of time, that is usually a really good sign. I mean,

basically what you're just saying, but just like stamp of "we promise we did this ahead of time"

31:19 Megan: Yeah, prevents HARKing, hypothesizing after the fact [Hypothesizing After the Results are Known], right?

31:23 Daniel: Yeah, it was kind of cool to see metascience, and also maybe kind of bibliographic analyses, looking at different trends in literature, but then also going beyond the peer-reviewed literature to looking at the real trends that influence people who are outside of the profession. And, I don't know if canary in the coal mine, is the right bird in the right niche here, but it's like: proposing unobservables is commonplace in research, like latent cause analysis and any kind of structural equation modeling. And here is the tour de force of unobservables, maybe that which is defined as unobservable. And so it's actually like a space to bring up all these pieces of epistemic hygiene about from pre-registration to the pace and the tone of the scientific community and questions of multidisciplinarity in research, it's a fun...

And then there's a heart at the intersection of the Venn diagram where it kind of all comes together. It's like, well, this synthesis cannot happen without all these pieces. If we're not having philosophers in conversation with the statisticians, then this synthesis can't happen. Now, maybe the synthesis that you care about doesn't need that, but we care about this and this synthesis requires it. So we need to develop the approaches and the communication around that. It's really a tip of the spear effort, even apart from the consequences of the research.

33:14 Megan: What a heartwarming sentiment. Thank you for sharing that. I love the phrase epistemic hygiene because that is so crucial, I think, to every field. But it's like, particularly aggressively exposed in this field, which is exactly why I think that my science has benefited so powerfully from close collaboration with philosophers and with statisticians. I mean, this is kind of the space that I live in here in the Cognitive Sciences department, is we're halfway between AI and philosophy and psychology and neuroscience and engineering and it's kind of at, like where all these things come together. But then this metascience thing -- I'm happy that you picked up on that because I think that, it's also really -- the bibliometric analyses, are really critical and we're at this crazy spot and have been for a long time now. But I think it's really coming

to a head where the vast majority of our scientific knowledge is not accessible to any one researcher simply because there's so much of it, right? You can't read all of the literature. You can't even read all the literature that's in your tiny little corner.

And consciousness science, like many other fields in this way, actually is one of those that brings together a lot of different fields. So it makes it even harder for you to keep up with the things that are going to be really relevant. I mean, you have to keep up with the cutting edge tools in neuroimaging data analysis, plus the epistemic hygiene that the philosophers are going to bring, plus cutting-edge behavioral paradigms and what they mean in naturalistic data collection settings. So that you're not just saying, oh, I've discovered something fundamental about consciousness by showing you Gabor patches all day. And I say this as someone who shows people Gabor patches all day. But it's a real challenge to bring together all these things. And maybe you're right. Maybe that consciousness science is, I don't know about the canary in the coal mine, so to speak, but maybe you're right that it's one of the places where you can really see all these cogs working together to come at one major question. Or maybe you don't quite see the need for that hygiene in some other fields, yet it still is there. Like latent cause analysis is not just something that we do in consciousness science or neuroscience. We do it in economics, we do it in sociology. We do it, like, everywhere. And so having a real handle on how to design stuff that actually asks the questions that you're interested in, is something that I find that I have to continuously work hard to keep in my sights. And I'm lucky that we've got a pile of philosophers that we get to hang out with who blow into your talk and say, "everything that you just said is wrong. And here's why. Here's this logical hole in what you've done." And they're right. And it's great because it makes the science better. And you don't typically get philosophers blowing into a talk in a lot of other fields. It doesn't happen. And I think it should.

36:43 Daniel: We all have that inroad to our experience. So it's something that integrates across disciplines, kind of even cast the disciplinary organizational paradigm into, at least critical light. And then goes even outside of academia because these are what people search engine for, and language model, discuss. And I think it is one of these... It's like an itch that some can't scratch with this inscrutable and ineffable nature that does verge into the mystical. So what do we do with the huge mystery... that makes it a training and exhibition field... Again, that's not just important, but is kind of the archetype of how do you have a multidecade conversation with potentially non-

compatible theorizing? Whereas in many of the physical sciences, including physical or reductionist perspectives on neuroscience, threads open and close, little bit quicker, little bit easier, tend to not delve into ancient history, tend to not need to invoke world knowledge traditions. So that makes it fun. It makes it fun and useful. And if something's fun and useful, what secret third thing are we looking?

38:31 Megan: Exactly. Sounds like if you weren't already a consciousness scientist, maybe we've converted you a little bit.

38:38 Daniel: As only a bug doctor. I did one work on the Ant colony and definitions of consciousness, and we didn't come down on the issue of whether the nestmates are conscious under what definition, or the colony. But more pointed out, well, if you define it according to some mammalian neuroanatomy, then you kind of already know what the answer is going to be. It's going to be no. And if you define it according to a specific primate centered symbolic communication approach, again, you know what that's going to be? It's no. If you define it based upon some generic informational property, then you already know what it's going to be. It's going to be on that continuum.

And so we kind of tried to flip the approach by instead of asking which feature would help us differentiate whether the ant colony is conscious or not, we just said, let's just look at what the features that people are using and then ask whether colony is [conscious]. But we don't have the 1 meter metal bar for consciousness. So again, it's like, well, let's say seven out of ten that we observed. We don't know how many other unproposed theories there are. So seven out of ten could be total sampling bias. Even if it was ten out of ten, then what would that type of consensus really mean? And that's where our road took us. And I saw that conclusion as like, a chance to broaden the discussion. But discussions are not only about broadening, because there's real decisions that are being made. So it can't only be "yes, and" and I think that when you connect it back to falsification and all of these other properties, that's where we get the winnowing. But it's those two complementary conversations, like the broader inclusion of perspectives that expands the space that we can comprehend, and then the diligence that also shrinks it back down and somehow will zigzag to better and better understandings.

41:07 Megan: Your point about we don't have a yardstick, we don't have a metal rod, right, that know how conscious. I mean, like, according to some folks, we have that metal rod, and we've surpassed that with, for example, large language models. And we're not just talking particular Google engineers who decide to get really excited about how their pet language model is conscious. We're talking any kind of reasonable interpretation of the old school Turing test would be passed by existing language models right now, in fact, arguably, it might have been passed long ago with Eliza in, like the '70s. And if it wasn't passed with Eliza, then certainly it has been passed now. But I think that there is a growing understanding that information processing capacity and intelligence are not the same thing as internal phenomenal experience, and that the tests that we have, to the extent that we have any tests at all, are woefully inadequate. And, as you said, are locked to particular implementations. So you can't apply the mammalian test for consciousness, like, oh, I'm looking for this particular neural signature, which tells me whether the monkey is anesthetized or not, and I can't apply that to ants and expect it to work. It's not going to tell me anything useful there. Can't necessarily apply it to octopuses either for the record. So we're not even going insects. We're going, other arguably incredibly intelligent beings that can open jars and be sneaky and do all sorts of cool stuff. And that have complex social interactions, and are basically aliens. This is my professional scientific opinion here, but they basically are, right? Like, they're so fundamentally, physically different from us. And so any consciousness ometer that we develop for us or that applies in monkeys or even in dogs or cats is not really going to apply there. And so differentiating tests for intelligence, from tests from inner experience is a really difficult problem.

And then there's the third problem, which is a test for whether we attribute consciousness to an agent, which, if you saw the movie Ex Machina, is the Garland test. So that's do -- never mind whether it actually has consciousness, do I attribute consciousness to it? Because that is going to change how we interact with it and the rights that we ascribe to it and so on. And so I think we're well past the point at which we need to get a better handle on this. Some of the stuff that I'm working on right now is moving in this direction. Not just me and a huge group of lots of other people. And I think Yoshua Bengio gave testimony to [USA] Congress, like today, about the need for increased regulatory oversight of who has access to so called artificial intelligence models so that we can better understand how their implementation and their

interaction with humans might exacerbate biases or cause all sorts of other problems. So you can actually go and read his testimony that he gave. I don't remember where the link is, go find it. But he had a summary and then he linked to the testimony. And I think that having folks like Yoshua and other giants in the field speaking out about the need for actually tackling this, and this isn't just a philosopher's playground to talk about consciousness. This is, as you said, the testing bed for where the rest of science is going. And it's also very topical right now.

45:02 Daniel: So what does that healthy conversation look like, in the case of the synthetic intelligences and language models and all of this? What does that continuum look like between the actual measures and proxies that we use in research, and what memes or themes or words that I guess, by definition aren't popular today -- like big data wasn't popular till it was -- so something like what has to come on the scene and come into the lab, do you think, to support the kind of work and knowledge that either of you would want to see?

45:57 Nora: This isn't an answer to your question, but it just reminded me of one thing that we need less of, is people writing about these interactions with AI that are like, "my AI told me that it wanted to get married", or like, my AI, whatever. It's not useful. It's not news. Stop reporting about it. That's all I have to say. Okay. Go ahead, Megan.

46:18 Megan: No, I wanted you to take this too, because I think that this question is about communication in a way that you're much more embedded in the science communication space than I am. And so for I think one possible way to go about this that maybe you can speak to would be what kinds you're Daniel, you're talking about what do we need to bring into the lab? Maybe communication tools is one of those or ways of communicating this science ways of, and to different audiences. And so maybe, Nora, you've got some ideas. You've done so much in this space.

46:56 Nora: I don't I mean, I guess what we've been talking about with people who study human consciousness, people who study consciousness and other entities as well, just being clear about what you mean by consciousness. Do you mean a subjective experience? Do you mean basically is a light on or off? Do you mean awake versus asleep? Just being really clear about what level you're talking at, I think is really helpful. Again, when you're just presenting your research, whether it's on Twitter or you're

talking to a journalist, really being clear cut about that so that people can't make kind of extrapolations from your work that your work doesn't cover. I don't know what else. Yeah, I guess just being willing to also talk about your work. I feel like a lot of data science feels pretty inaccessible to the general public. So finding ways to communicate what you do and how you're conducting your work is helpful. Being open about it.

47:59 Megan: There's a lot of jargon in our field too. In any field, there's jargon. But the oversimplification this is going back to what we talked about at the beginning. The oversimplification of jargony terms in our field seems particularly susceptible to creating a situation where the facts haven't changed, but the interpretation has. And so I think it's almost like sensitivity training for anybody who's in this space. Like just kind of a tutorial that you can do, that's like a two hour click through thing. It's like, here are all the ways in which communicating this type of science, due to its nature, is more challenging than you might anticipate.

So my own involvement, in a program run by the Canadian Institute for Advanced Research, has given me a little bit of training in speaking with the media. And I would never say that I am an expert in this at all. I will only say that it was eye-opening, and it was very useful in the clarity of language that you are used to using the precision of language that you're used to using in a close scientific sphere versus when you're speaking to a more general audience. And when you're speaking to a journalist or with several journalists who are then going to be writing for a more general audience. It's a different mindset. It's a different way of speaking. And even just being aware of that, I think is really useful. It's not that one is better than the other. It's just that they are very different. And that when we are training to be scientists, when we're doing a PhD in a field related to this, speaking to the general public is not a skill that gets pressed on. It's not a skill that gets part of your professional development training. Maybe you do like one practice talk somewhere, but it's not typically part of a general training protocol. And so speaking to non specialists, speaking to the media, speaking to high school audiences, speaking to your mom at the dinner table -- learning how to do this effectively can actually be really valuable and really rewarding and really powerful. And again, I would never say that I am an expert at this. At this point. I just like to think that I'm a little better at it than I otherwise would be had I not had it drilled into me how careful I need to be.

50:33 Nora: I would also say, don't be scared to email journalists if you see that something's inaccurate, you know, speak up like Megan has done about kind of how things are portrayed inaccurately. Because, yeah, as a journalist, no one's ever done that to me, but if something was inaccurate, I would want to know and I would want to fix it, like ASAP. So don't feel bad about emailing journalists. They want their pieces to be accurate as well. So that's what I would add, that can add to the conversation.

51:05 Megan: It would make me feel a little bad about calling out the pieces that I did in the presentation and the piece of writing that I did too. But at the same time, they put this in writing, and this is wrong. I don't like making people upset and I don't like making people angry. But it's out there in the world, and it's got a million eyeballs, and that's a problem. And so we're hoping your viewership is about a million, right, Daniel? So give or take low millions.

51:37 Daniel: Low millions. Low millions.

51:39 Megan: So this will cover everybody who read those articles, right?

51:45 Daniel: It's really interesting. The field is about awareness of other minds, our own mind, but also awareness of other minds in theory. But then in practice, awareness of other minds, is communication. Because if we say something that it's like, well, "I wouldn't be annoyed by that", or "I wouldn't be angry with that". But you missed the point of communication, which it's not about what you would think about it, it's about who the recipient would be. So it's kind of like the theory and the practice of situational awareness about different minds, all of which are different than our own. Some are potentially radically different than our own. Others might be more similar. So there's really maybe even a quintessential relationship between consciousness studies and communication studies, which provides a really unique two way street, that the world is swerving into that two lane highway with these questions that are grabbing people's salience.

What are your sort of closing thoughts or directions, or what are some exciting areas that you'd like to see unfolding in the coming months and years?

53:21 Megan: Well, I'll go first. Yeah, first of all, I think you're spot-on by saying communicating consciousness science, being about knowing about other minds. I

mean, it's like effective communication is theory of mind, and theory of mind may have a lot to do with modeling other minds and modeling your own mind. And yes, absolutely, it's all wrapped up. So I think for me: getting this right going forward, or continuing to work towards getting it right, is a priority for me. And one of the pieces scientifically that I'm working on that I hope to then communicate effectively when we get it right, or several of the pieces is: I have a couple of these really wonderful large collaborative projects where we're working on everything from figuring out how you would actually measure consciousness effectively, or what it might even take to measure consciousness effectively in other entities that are not necessarily, like, awake, behaving, healthy, adult human beings. All the way to, let's actually design some experiments to test several different theories of consciousness. Let's design new -- some of what Nora's working on actually, is designing new measurement approaches to say, well, we need to actually have a quantitative handle on the things that we're talking about. So this becomes objective, it becomes falsifiable. We can do model arbitration.

So all these things I'm really excited about, but overarching all of those is -- this idea of going it's all connected, right? You talked about how consciousness science might be this leading edge or wavefront of how interdisciplinary science and metascience needs to be done going forward as we become even more theory-driven in some of our scientific lines of inquiry than we have been in the past, and more interested in latent variables and causal discovery and so on and so forth. And as the science teams get bigger and more complicated and the jobs within those science teams become more specialized and we have more and more need for interdisciplinary collaboration, we're going to have to change how we do team science, and how we do credit assignment within team science in a way that I think might end up being kind of incompatible with the nice, siloed, cute departmental structure that we have in our universities.

And so a focus on not just tolerating, but celebrating interdisciplinarity, celebrating team science, doing credit assignment correctly, and saying: first author isn't the only thing that matters, that it really matters. If you wrote this gorgeous software package that facilitated a whole bunch of stuff that's also a meaningful and powerful contribution. Even if you didn't get first author on that paper, you still deserve a lot of credit. So I think that there's a lot of shaking up that we need to do about how we do science going forward. And I really like the idea of using consciousness science as a case study. I think that's beautiful. And thank you very much for making that lovely connection, because it

really locks together a lot of the things that I've been thinking about recently as well. So there's my parting comments.

56:48 Nora: Yeah. I was also going to bring up these huge projects that you're part of and that other people are part of. It's really exciting to see so many people working together in these huge teams. I feel like it just makes science so much more efficient and more careful. So that's very cool.

Another thing I'm hoping is that one, that journalists don't get scared of covering conscious of science from this. I think we'll learn from our mistakes and we'll move forward. I don't think we'll get scared, but I hope that there's more coverage of this field. And I also hope that, something that I've noticed about science journalism, is they really like to just have clear cut findings because that's the simplest thing to communicate to people. But I think we can, as a society, learn to be comfortable with the ambiguity a little bit more, especially when it comes to conscious science. We might have found something, but we're not sure, and that's okay. And that's science. It's okay if your headline isn't snappy and clear. It's important for it to be clear, but snappy and, I guess have one takeaway point. It's okay if it doesn't have a takeaway point. Yeah, I think that's what I'm excited about. New era of science journalism.

58:00 Daniel: Well, it sounds like bigger teams, bigger community, more theory, more data, more philosophy, more ambiguity. It'll be a great time.

58:15 Megan: More philosophy, more ambiguity. Love it. Yes.

58:19 Daniel: Thank you, Megan and Nora, for joining. Always welcome back. So till next time.

58:28 Megan: Yeah. Thank you so much. This has been really a pleasure. Thanks for having us. Thanks.

58:33 Daniel: Thank you.

58:34 Megan: Bye.