00:34.22 And since my paper has been so conceptually proliferating, I will now sit down. I am sitting. And to learn from my fellow panelists. Thank you.

APPLAUSE

MARK SIDERITS

00:34.40 Thank you very much. Ok. We are going to have three of our panelists responding and they're going to be in alphabetical order. Our first respondent is Joseph LeDoux who is a neuroscientist. He is Professor at the Center for Neural Science here at NYU.

JOSEPH LEDOUX

00:35.15 Thank you Chris and the other organizers for inviting me. I think I'm the token neuroscientist at the meeting, so I have a big job, but I'm not gonna try to carry that out. So I want to tell you about something that I know a little bit about, which is emotions in the brain and try to relate that to Bill's talk.

00:35.34 One of the- and I apologize that we can't see this that well, but- Can you see that in the back? One of the concepts he brought out was this notion of, if I can get it right, _laya-vijñ_na, a form of subliminal, cognitive awareness that serves in the unconscious structuring of the world.

00:35.52 Now if we change cognitive awareness to the word cognitive processing or representation, we can find a lot of overlap with modern ideas in cognitive science and brain science that relate to this idea. Because in cognitive science today, we think of much of the mind as operating unconsciously.

00:36.10 Not necessarily in the sense that Freud talked about where things are repressed and unhappy thoughts are put out of the mind, but instead most of what the brain and mind is doing is operating below the level of awareness. And I

think we heard a bit about that in Owen's talk this morning, as well.

00:36.27 So this emphasis, I think this emphasis runs throughout Buddhist literature – to the extent that I know about that, which is very little – but, I've read a little and found a lot of references, for example, in Zen literature to unconscious aspects of mental life. And I think this, you know, this again cuts through much of modern understanding of the way the brain works and it definitely interplays quite a bit with the conscious and unconscious aspects of emotion in the brain that I'd like to tell you a little bit about.

00:37.00 So first, let's just ask what an emotion is and the standard answer – that as William James pointed out, the man on street would normally say – an emotion is something that we subjectively experience. A conscious feeling. And this is certainly part of what we mean by an emotion and

it has to be a central part of any theory of emotion that we might want to come up with.

00:37.26 But the fact is, in reality, the conscious feelings are only a small part of what goes on in any particular kind of emotional situation. Freud called this the tip of the iceberg and that, I think, is a very nice metaphor for it. And again, to make the same point over again, consciousness is blind to much of what the brain is doing.

00:37.47 And Owen pointed this out – it's a good thing that this happens because we can't have privy to all of the action potentials and neurotransmitter releases and the muscle twitches that all that's controlling, because we'd never get anything done in our lives. So consciousness is standing far apart from much of the operation of the brain.

00:38.06 And not just in the, we could call that the neural unconscious, but at higher levels, as well. Much of our mental life takes place

unconsciously, as common example is the structuring of the syntax of a sentence as you're speaking it. You don't consciously plan that, it just comes out. Now the ego-centric perspective of consciousness, as Bill pointed out, is largely symbolically constructed and linguistically dependent.

00:38.33 That doesn't mean that everything that we're conscious of is verbal and linguistic, but most of it is symbolic. But once you have language, as soon as something enters your consciousness, you do linguistically interpret it and it becomes linguistic after the fact. We discriminate, categorize, label our experiences, including our experiences of our self and our emotions.

00:38.55 So, in spite of consciousness being a very important part of our emotional life and here we see – I don't know if you can see it at all – but we've got Jack, who's angry and Shelly who's afraid there. And so those are the feelings that

they’re experiencing, but in addition to that and the second part of the two aspects of emotion –

00:39.23 one is experience, the other is the expression of emotional responses. So, as we go into the brain and body, we can see there’s a lot of stuff going on during any kind of emotional reaction. The brain is obviously responding, hormones are being released, the autonomic nervous system is active, muscles are being tensed up. Some of that is being driven from the top down.

00:39.46 So, you first detect the emotional stimulus and your body then responds on the basis of what the brain’s done. But some of that then feeds back and can affect what the brain is experiencing, as well. So the relation- This causes us to ask the relation between feelings and emotional responses.

00:40.05 So by the common sense theory, feelings are thought of as causing the emotional responses.

You see a snake and you run away because you're afraid of it. But William James questioned this idea long ago and flipped it around and instead said that responses cause feelings.

00:40.22 And Tony Demazzio (ph) has a modern version of that theory. Not everyone agrees with that and I'm not a major proponent of that particular view, but I think there's another way to think about it, which is that feelings and responses are both products of brain systems that function unconsciously, that detect stimuli and produce responses.

00:40.42 So, let's look at these in graphic form. So, in the top, the common sense idea, the stimulus produces the feeling and the feeling produces the response. The response primacy idea is that the stimulus produces a response and the response is what causes the feeling. And then the unconscious processing idea is that the stimulus is processed

unconsciously by our brain systems that are designed by evolution to do this.

00:41.08 And both the response and the feeling are products of that and there can be interactions between those, as well. So, you know, the bottom line from the scientific point of view is that emotional responses aren't necessarily dependent upon feelings, you know. Once you have a feeling, that can, in a kind of top-down or downward causation way, obviously affect what we're gonna do.

00:41.31 That's one of the things that, you know, that science hasn't come to complete terms with, in terms of understanding how thoughts can cause behavior or how feelings could cause behavior. But I want to sort of sidestep that for a while and just emphasize the unconscious aspects of all of this.

00:41.48 So there's just mountains and mountains of data from psychology and brain science that support this idea that emotions can be elicited unconsciously. So, if you present stimuli subliminally, you can have autonomic and other reactions to those stimuli, you can even learn about those stimuli without ever knowing that you're learning about them.

00:42.07 You can have responses without ever knowing that you're experiencing the stimulus or experiencing the response. And brain research has shown us a lot about exactly what sort of mechanisms make this happen. So, in the last few minutes of what I want to do, I want to cover several things. One is what goes on in the brain to cause emotional response. Then I want to look at the question of can these emotional responses tell us something about feeling.

00:42.33 So, if you look at someone's emotional responses, how good is that at telling you what's going on

in their minds? How might feelings actually come about in the brain? And finally, what's the relation of all this to meditative states. So, the emotion I'm gonna focus on is fear, because that's the one that we understand the best.

00:42.57 So, a threatening stimulus goes into the brain, it's processed through sensory systems and ultimately reaches this part of the brain called the amygdala, which then controls the fear responses, including behavioral and autonomic and endocrine responses and so forth. Now, there are two ways that this can happen. One is directly through the sub-cortical sensory channels.

00:43.18 So the stimulus is detected by receptors in the eyes or ears. It goes up towards the, into the brain. Enters the thalamus and from the thalamus can directly activate the amygdala. It can also get to the amygdala through the cortex. The thalamic pathway is called the low road. It's a quick and dirty processing system. It activates

the amygdala quickly, but you don't know much about what the stimulus is. So if a bomb goes off in this room, we'll all have an immediate emotional reaction and then you realize what's going on.

00:43.48 It's through the low road probably that these startling and you know, the blood pressure rising and your muscle tension and all of that's gonna be elicited. And through the cortex, you'd then analyze the nature of the sound and begin to think about it in more complex ways. So, in this example, the hiker's walking through the woods. He's about to step on a rattlesnake, but through the low road, he freezes and protects himself.

00:44.12 The basic evolutionary point of view is that you're better off treating sticks as snakes than snakes as sticks, so you sort of over-generalize and protect yourself. Now, in a way the amygdala's a misnomer because it has about a dozen or so different parts and not all of them

are involved in fear. We know a lot about the micro-detail and I'm just gonna tell you about one level of detail, which is the inputs come into the lateral nucleus, the outputs go to the central nucleus from the lateral and then the central controls the responses.

00:44.42 Now within each of these structures, there are also multiple partitions, each of which plays different roles. We're not gonna go into the details. We know a lot about the chemistry and molecular biology in the genetic organization of all of this, but that's beside the point for today's talk.

00:44.59 So, can we use this information if we, you know, hook somebody up to a machine and we see that they're having all these responses and we know they're in a fear response, can we use this to say that they're feeling fear? So, what we want to know is how good is behavior in allowing us to

judge the emotions of others? This goes back to Susan's talk this morning – theory of mind.

00:45.24 And one of the things we use to develop a theory of mind about what somebody else is doing or, more importantly, about what they're about to do is on the basis of what they're doing now. So how good are we at that? And how accurate is behavior? We do this all the time in our behavior, so-

00:45.45 In this case, we can probably say that these two people are feeling something very similar. We can't be a hundred percent confident, but chances are if people are expressing this kind of emotional reaction, they're probably both experiencing something similar. Here, we might say that it's, you know, probably, you know, maybe, say probably, but who knows. I mean, there are a lot of differences between other primates and humans, so let's say maybe.

00:46.16 Possibly, but you know, we're getting further away from what we might be comfortable with. Even further. Here we don't know. Down into the lowest level of vertebrate evolution, invertebrates. How far do we want to go? These are bacteria living in a Petri dish. If you squirt acid in that Petri dish, they will all move to the other side of the dish. So, they're having a defense reaction to an external stimulus. What are they feeling?

00:46.45 These are living organisms, if they can react to danger without being conscious of it, why should we have to be conscious to react to danger. And we know we don't have to be. So this doesn't solve any problem, but it does tell you that we have to be very careful when we're judging what someone is feeling on the basis of what's going on externally in terms of their behavior.

00:47.07 And, you know, on and on. So, you know, if behavior isn't that reliable, on what basis- If behavior isn't perfectly reliable, on what basis

can we attribute homologous, subjective experiences to other organisms. Well, the obvious answer is they have to have similar composition and if they have different kinds of composition, that means they either have different kinds of subjective experiences, or they lack those subjective experiences.

00:47.36 This is basically a version of Nagel's "What is It Like to Be a Bat," because it's gonna be different because they have different compositions. So, here's a bunch of animals and they all obviously have different physical composition from the outside. But the composition we care about most is obviously the brain.

00:47.55 So, brains are different, but they're not completely different. Every vertebrate brain has three major regions with subdivisions that are consistent throughout the evolutionary history of the vertebrate animals. The hind brain and the mid brain are the most similar. These are the

parts that are necessary for sustaining life, so it makes sense that those parts would be similar across species.

00:48.18 The forebrain differs the most across the vertebrates and the prominence of the neo-cortex distinguishes mammals from other vertebrates. So, if the parts that happen to mediate consciousness are the same, subjective experiences could be the same in all these animals. So the question then is, where is consciousness in the brain. And of course, this is the big question.

00:48.40 And it all depends on what you mean by consciousness. And we heard different people this morning talk about different aspects of consciousness and I want to keep it as simple as possible by using a relatively straightforward aspect of consciousness, what we might call short-term or working memory, which overlaps with things like attention or what Ned Block calls

access consciousness or what's been referred to as the easy problem.

00:49.08 You know, as neuroscientists, we try to tackle the easy problems rather than the hard ones, so we're not gonna go into the hard problem of consciousness. Let's just see where we can go with the easy one. So, how do we consciously experience some stimulus in this access way, this intentional way. Well, there's the stimulus – it's processed by the sensory systems. Those sensory systems deliver the stimulus to working memory, where we have a short-term temporary representations.

00:49.37 The advantage, the importance of working memory is that it's able to integrate information from a variety of different sources and put it together and take what you might say, transfer, you know, a simple percept into a concept. So, it's able to integrate different aspects of it. Not only, you know, what it is, but memories we have about it –

both semantic and episodic memories can enter into it. So if there's a snake on the path, that'll enter working memory.

00:50.04 You then have a memory, you'll retrieve memories about experiences you've had with snakes, things you know about snakes, personal experiences with them. Alan Baddeley has been recently talking about something called an episodic buffer component of working memory, where you would have these episodic experiences by integrating all of this kind of information.

00:50.26 So, the question is how does working memory work. So, working memory depends on a part of the brain called the lateral prefrontal cortex. And what's important is that this part of the brain is present in primates, but not other mammals. And it differs- It's the part of the brain that differs most between humans and other primates.

00:50.45 So, we're starting to get clues here about what could be important in terms of human conscious experience. Especially since this is the part of the brain that is involved in working memory where we might say the working memory is a kind of platform, or makes external events and internal events available into subjective awareness.

00:51.09 So, this suggests that because of the differences in the way working memory and the prefrontal cortex are organized that there must be differences in the way this kind of experience is gonna take place in other animals. And if you add in the importance of language together with the uniqueness of the prefrontal cortex, we have a lot of ingredients that we would need to make human conscious experience different from that in any other kind of animal.

00:51.37 So that's not to say that other animals have no conscious experiences. Animals might be capable

of all sorts of subjective experiences without prefrontal cortex and language, but whatever those experiences are, they're gonna be different in the absence of those capacities. So this, again, is a kind of neural version of Nagel's idea.

00:51.55 So- I'm getting towards the end here. So, how then might we become afraid or where, you know, consciously afraid? How might we be fearful of some external stimulus? So we have the same basic ingredients, but now we also add in the emotional reactivity that the body is going through. So the stimulus is in working memory, you're retrieving long-term memories about the stimulus.

00:52.18 So, you've got that sort of cognitive representation. At the same time, the amygdala is feeding information into working memory. It's also causing bodily responses and those are coming back and feeding back into working memory. And I think that- You know, those ingredients

will go pretty far in giving us what we need to be, to have conscious access to the fact that we're in an emotional state.

00:52.40 Now, again, this doesn't solve the problem of the qualia, the phenomenal experience, but I think it takes us a long way towards some things that we can study scientifically in terms of emotional experiences. Now, I just want to finally turn to the question of meditation and working memory. So, to the extent that working memory involves temporary representation and executive control-

00:53.04 I haven't talked about executive control, but that's the ability to willfully control your own mental processes. So, through attention you can select things in the environment that you want to focus on, and so forth. And it's basically regulating your own mental states. Meditation seems to be, you know, a very nice example of executive control, where sensory and other kinds of inputs into working memory might be blocked.

00:53.29 So this again, is the kind of working memory hypothesis of cognition and emotion and then meditation might, through executive control, might be a way of shutting out these kinds of external and internal signals from entering into awareness so that you now have a kind of- I forget what the term Owen used this morning- but a kind of pure consciousness that's isolated from the other events.

00:53.57 Now, sometimes in the Buddhist literature meditation and meditative states are described as achieving a kind of child-like or state like a frog, which implies it's, you know, it's going to a lower evolutionary state, but instead this is such an exquisite process that seems to be unique or at least fairly unique to the human brain, that I think it might be better to think of it as a unique achievement and entering into a kind of state or a kind of plane that can only be

achieved by the unique capacities of the human brain. So thank you.

APPLAUSE

MARK SIDERITS

00:54.42 Thank you, thank you. Ok, our next respondent is Evan Thompson, who is a professor of philosophy at the University of Toronto. He works in cog-sci, but also philosophy of mind and phenomenology.

EVAN THOMPSON

00:55.01 Ah yeah, no I think it is. Yeah. Well, I'd like to start off by saying it's a great pleasure to be here. It's a very rich and stimulating event and it's a privilege to be able to take part in it. I also am going to read my remarks because I wrote them as a commentary on Bill's essay so that they could then be posted on the Web site for this meeting. So, you'll have to bear with me as I present it in that way.