**Your Mind on Language & Emotion, with Dr. Ajay Satpute**

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0:00:04.8 Beth Fisher: Welcome to Minds Matter, I am Beth.

0:00:07.0 Ava Ma De Sousa: And I'm Ava.

0:00:08.2 Beth Fisher: And this week I spoke to Dr. Ajay Satpute, an Assistant Professor at Northeastern University and the Director of the Affective and Brain Sciences Lab.

0:00:17.1 Dr. Ajay Satpute: So I'm a social and affective neuroscientist, and I study how the brain represents emotions and feelings and social cognitions more generally, or how people think about people as people rather than as objects. And so we often infer beliefs and feelings and emotions in others, but we don't do that for chairs or I don't know. Maybe we don't do that for spiders, maybe we do. [chuckle] So that's what I study, and I use fMRI as my main method. So we put people in MRI scanners and look at blood flow in the brain when they're feeling emotions or doing various tasks.

0:00:50.1 Beth Fisher: So the basic emotion view is that there's a limited set of emotions, and there's this distinct psychological signatures in neurocircuitry, so the idea is that we experience something and that will provoke an emotion which leads to a psychological response. So in this view, language is just used to communicate the emotion after we experience it, is that correct?

0:01:11.1 Dr. Ajay Satpute: I think that's more or less correct. I think that many views, it starts kind of in one way, and then now there are many people who've made it much more complex than it initially was as new findings have emerged. But I think you've captured some of the core pieces. It's common amongst many basic emotions theories to assume that emotions are inborn and that there's a handful of emotions that are more core and critical than others, in the sense that these are the ones that have been passed down in some way, shape or form through evolution across the species. There are plenty of other emotions in this view, but some of them might be culturally constructed, some of them might be derivatives of these more core emotions according to that view. And also language is not considered to be a necessary component of the emotion.

0:01:58.1 Beth Fisher: Your work involves a constructionist approach to emotion, so could you explain a bit about that and how that differs to the basic emotion view?

0:02:06.7 Dr. Ajay Satpute: According to constructionist theories, emotions aren't elemental units. I think it's actually useful to distinguish between affect and emotion, 'cause I think this is a key piece, so let me just do that first. So affect generally refers to feelings from the body, and that might be painful feelings or pleasurable feelings or feeling really amped up and awake or alert, and sometimes feeling sleepy. And so usually affect is understood as falling on two dimensions, one is called valence, which is just pleasure, displeasure or positivity, negativity, and another one is just arousal or wakefulness versus sleepiness. And according to constructionist theorists, those are dimensions that describe feelings in the body that we have present at birth or pretty inborn that we have these feelings.

0:02:55.8 Dr. Ajay Satpute: But emotions in contrast refer to these discrete experiences like anger, fear, disgust, joy, sadness, calm, melancholy, etcetera, that we have as well. And so, according to constructionist theory, these emotion categories are learnt through culture and passed down through culture. And the way that they're made is a child or an infant starts growing up, and essentially there's feelings in the body, and those feelings are not necessarily differentiated as a specific moment of fear or disgust, we interpret it that way based off of context and prior experience. And so I think there's ways to draw analogies to many other fields in psychology that kind of have the same argument. For instance in vision science, if you look at many different visual illusions, we can find that these visual illusions are using prior experience to make an interpretation of what we're seeing, and then it just presents itself that way to us.

0:03:58.1 Dr. Ajay Satpute: So one of my favourite ones is actually the inverted face illusion, where if you take off a mask and then you turn it around so you're looking at it from the inside, it looks like it's protruding even though actually it's going in the opposite direction. And so this is a very strong illusion, but one of the explanations for it is that we're using prior experience, which is that faces tend to be protruding outward to interpret an otherwise ambiguous or uncertain visual input. In constructionist theory, part of that uncertain or ambiguous input is feelings from the body, it's not always clear what they mean, and so then we use prior experience to interpret that as an instance of anger or fear, or rage, or pride, or shame.

0:04:39.8 Beth Fisher: Also in vision science, I don't know if this is connected, but there's a whole debate of the rainbow as a continuous spectrum but we report on colour and categories. So we say red, orange and we don't report on it, and there's this thing, well, are we perceiving the colours categorically or we perceiving them continuously? And then there's some sort of mechanism in which we put them in categories. Is that similar to this constructionist view of emotion?

0:05:04.4 Dr. Ajay Satpute: Yeah, I think so. So I think that insofar as most inputs tend to be ambiguous and uncertain, we need to make meaning of them somehow. In the sense we carve out some meaning out of it, which in a sense warps it, and that's in part when you get these... I think what you're referring to is a category boundary effect. A division between green and blue, if it's slightly more on the blue side, it appears more blue artificially than it would if you were just looking at it without knowledge of these categories.

0:05:36.0 Beth Fisher: What kind of studies could we use to test these two theories of emotion?

0:05:40.3 Dr. Ajay Satpute: There's a lot of different kinds of studies, and I think that some family of studies is mostly about finding a lack of evidence if you will, for predictions from the basic emotions theory view. So are infants born perceiving facial expressions as distinct from each other? So this is more in the realm of emotion perception rather than emotion experience or seeing emotions in others versus experiencing them in yourself. But there's studies in infants looking at, Do infants distinguish between anger, facial expressions that our society stereotypically refers to as anger or disgust, or do they respond to more lower-level features like just the teeth? And then the teeth might look a little different in one versus the other, and that actually might end up accounting for any differences, but it wouldn't necessarily be a facial expression per se. So there's a whole line of work that is trying to look at whether some of the fundamental predictions from a basic emotions camp are actually upheld or not. But I think to me, the more interesting ones are what are the ones that constructionist theory might pause a bit? One way to look at that is by looking at neural mechanisms of emotions.

0:06:47.1 Dr. Ajay Satpute: So according to one view, fear for example, there might exist a circuit or a pattern for fear that explains maybe all of the instances in which we feel fear in life, and so insofar as a very cartoonish view might argue that there is a on-off circuit for fear... I call it cartoonish, but there are some proponents of this view in the past, maybe not so much anymore, but when that circuit is on, you feel fear and when that circuit is off, you don't. One way to test this view is to have people feel fear in a wide variety of situations and see if there is evidence for a neural circuit that predicts fear across all of these different situations. So I think that's one way to do it. It's something that my lab has been working on actually.

0:07:30.8 Dr. Ajay Satpute: I think another way is to ask instead of looking at situational variance, subject variance. So the idea is that if there's an evolutionarily conserved mechanism for fear that exists across species, then presumably it's present across humans as well. Different humans will have the same kind of circuit that underlies fear, and so you can build models that try to determine whether people do in fact share a core circuit or whether your neural representations for fear are actually quite different than my own. We've been testing some of those theories out as well using some data-driven methods to look at the brain data. When we started this project, we focused on fear actually in one study, and we're trying to look at whether different varieties of fear share a mechanism. I think it's interesting to consider that most studies don't try to look at situation dependents in fact. Most of them assume that there is already a common mechanism and just treat the data that way.

0:08:26.9 Dr. Ajay Satpute: So I think in the science of fear, probably one of the most popular ways of thinking about fear is in a predator-prey context where there's a chase and all that. But I think that's just one of many different varieties of situations in which we feel fear. So another really poignant one is fear of heights, where there is no predator, really, necessarily, and it can be very powerful. Another one is fear of spiders, which maybe a spider is a predator and it has that dynamic, but maybe it isn't. And of course, there's other ones like fear of social others not because they're gonna attack you in any kind of physical way, but because of how they might socially evaluate you.

0:09:04.1 Dr. Ajay Satpute: So we looked at fear in these three different contexts and found very, very little evidence for consistency in the brain regions that predict fear in each case. And the other finding is that the brain regions that do predict fear don't seem to be the ones that are frequently discussed as having been evolutionarily conserved across the species. Usually when people think about so-called core brain regions that support fear, they think of the amygdala, they think of other sub-cortical structures like the periaqueductal gray, and there's no doubt that these areas are really critical for defensive behaviour, meaning things like running and fleeing and freezing. But the assumption that behaviour and emotion are the same has been really challenged and questioned. It seems to be the case that sometimes people attack in anger and sometimes people attack in fear, and I would venture that sometimes people attack out of amusement. I think that the assumption that you can rely on behaviour alone to understand subjective experiences of fear in humans is a little tenuous.

0:10:09.0 Beth Fisher: I was just thinking back to your example with the fear of heights compared to fear of spiders or in social situations and that subjective feeling that we have, I think I would consider that those experiences are different. Either fear or anxiety or something but yeah, I don't think you would call those the same in terms of subjectively, how you feel.

0:10:25.9 Dr. Ajay Satpute: So I think this poses an interesting problem, which is sometimes, at least in our studies just as a side point but I think an important one, is we accept that people feel differently in different situations, and our goal is given that someone indicates that they feel fear is there then a shared mechanism or not? Some people I have found have no fear of spiders, and that's fine. For our studies that's fine, we basically just accept that those trials are not viewed as fear-inducing trials for that individual, and some people don't have fear of heights as we know from some really famous individuals that don't seem to have fear of heights. I think that incorporating subjectivity is really important, in a sense by definition, subjectivity means that people are gonna experience the world in different ways, but it's also that part that I think is so interesting and important, that conscious experience of fear, that phenomenological quality that is the part that when we feel it, it's what we want to go to a therapist about and talk about and help ourselves overcome in really debilitating cases, or it's the thrill that we seek out in certain cases as well.

0:11:29.5 Dr. Ajay Satpute: So I think that's just as a side point, the subjective part of it really matters, and I think that to your point, yeah, maybe if I'm a person who feels fear in a situation involving heights and fear in a situation involving spiders, there are certainly different situational elements that might make it seem like they ought to be experienced differently. And I think that's certainly the case. And the debate has really hinged on whether there still remains a core element there that is still shared across them, that we can say that's the core mechanism of fear or whether there is no clear evidence for that core mechanism even, 'cause you can imagine that there's probably gonna be some differences, but are those incidental differences or are those critical differences? In a constructionist theory, those differences can really matter, they're part of what creates the richness of subjective experience, in that there may not be a so-called essence that's shared across all of these instances of fear, across situations, that they might be constructed in different ways, in different situations.

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0:12:36.4 Ava Ma De Sousa: I honestly, before this thought emotion in terms of the feeling and language is completely separate, and that the language that we developed to explain the feelings is just purely for communicating and it didn't change our subjective experience of how we're feeling. And I think that that's what most people would assume.

0:12:56.1 Beth Fisher: So you're saying that you intuitively felt like you had an emotion and then you label it? Did you have this basic emotions view that there are real emotions that exist in the sense that fear is one thing that definitely exists and that you can feel? Or did you feel like I can have these stressful sensations in my body that I then label fear?

0:13:18.2 Ava Ma De Sousa: I thought that there was a group of feelings that were the same and where I've used fear to label that, but they all come under this same feeling that we associate with fear. And then everyone across the world has this feeling and then they've labelled it, and then it just changes in terms of what language you're using, but then that fear that we have is something universal. Does that make sense?

0:13:43.6 Beth Fisher: Yeah. I think evolutionarily, and to me, it still makes sense that there are some elements of basic affect that might be more like something like basic emotions as Ajay was talking about. It's not really cut and dry even in the literature now, but because fear, obviously, evolutionarily is so important, it makes sense that potentially there is something like that. But as he mentioned, there's no actual circuit for fear, and one of the findings that I found was the craziest and was a huge issue in how psychology often goes when I was an undergrad was this study that they had done where... So in the past, we used to think that there was a really clear fear center in the brain, which is this brain region called the amygdala. Now, we don't think that anymore. We know that the amygdala is actually a salients detector, meaning that anything that's important to you in the environment, it will kind of go off. And we still don't really know exactly what it does, but that's a big part of it, and obviously it goes off a lot when we're scared because we should be attending to things that we're afraid of.

0:14:44.1 Beth Fisher: But in the early 2000s, at the beginning of neuro imaging studies, there was a study that came out where they had both black and white UCLA students looking at faces that were both black and white faces. They found that when white people were looking at these faces, the white students would have this amygdala response to the black faces, and they interpreted this as fear, but they also then found that the black students were also having amygdala response to the black faces. And the way the paper interpreted this was, we know this is the fear center, which they didn't, and then they said, "Okay, well, so black people are also scared of each other," and that was the interpretation that they made. And so, that's obviously insane. And so that was also one of the reasons... So this is something called reverse inference in neuroscience, where we think because this region is involved in fear, then if this region is lighting up, then that means that the experience is a fear experience. That's not the case. And so one of the things that I really appreciated in hearing about Ajay's work was that he is incorporating subjectivity so much in his work, and that seemed to be one of the core tenets of what he's doing, which clearly is very important to looking at emotions when you're talking about fear, and that this is potentially universal.

0:15:54.7 Beth Fisher: And that I think it feels like it should be that way. And I think also intuitively, one of the interesting things about the constructionist approach is that there's valence and arousal. So there's those positive, negative versus something being... Feeling really excited in your body, or feeling really sleepy in your body. So there was a really interesting study in the '60s from Schachter and Singer, that was a very old school study because part of it involved them secretly giving adrenaline to their participants and not telling them that they were giving them adrenaline.

0:16:25.6 Ava Ma De Sousa: So you can't do that anymore.

0:16:26.8 Beth Fisher: No, you can't do that anymore. That doesn't pass our ethics board checks anymore. So in the study, they had a bunch of participants, half of them were given adrenaline and were not told that they were given adrenaline, and half of them actually knew that they were being given adrenaline. These participants were sitting in the waiting room and they didn't think that this was part of the study, but they were sitting there and they saw someone who was either super angry and just getting really aggressive and was acting out in this really angry way, or someone who was extremely euphoric. Super joyful, super euphoric. So the participants, they have adrenaline in their body, so they're feeling weird, and the people who don't know that they were injected with adrenaline don't know why. So based on that, they then asked the participants, "How are you feeling?" And they were like, "Well, for some reason, I'm so angry."

0:17:14.7 Beth Fisher: The ones who were around the angry confederate who was just an actor, they felt really angry. They interpreted that feeling in their body, that basic affect, as the label of anger. And the opposite happened for the people who were seeing this euphoric person, and then interestingly, the person who knew that they were being injected with adrenaline, they didn't feel any type of way because they knew how to interpret it. So there's this idea that context is so important to influence the way that we're interpreting our feelings, and I think we talked about this also in the love episode. But that's why it actually can be a good idea to take your first date out on a roller coaster or something, because they might not interpret it as fear, they might think, "Oh, I really like this person." So they'll interpret that as butterflies because they like you. So context and making people feel like basic affect, if you put them in a different context, that can really influence the way that they're interpreting it.

0:18:06.3 Ava Ma De Sousa: I just feel like because our emotions and how we feel is so much part of who we are, it sometimes seems hard to accept that it can be influenced like this. You think, "The way I feel is who I am and I can't be given adrenaline and put in a context and become angry," because you just have this feeling... I feel these things because I am Beth or I feel these things because I'm Ava, and when you start thinking about it, it kind of feels like, "Oh, who am I? I'm so confused, so easily influenced with how I'm feeling," I guess that's where my reaction to this comes from.

0:18:38.0 Beth Fisher: I think part of it is also how ambiguous is the situation? So if you're feeling super tired and you know it's because you haven't eaten anything in six hours, you're able to interpret that with that idea that it's just something physiological, whereas if you don't remember that or something then that leads you to potentially be like, "Oh, I really hate being here, I'm having a terrible time reporting this podcast," or whatever it is, which we're not...

0:19:02.0 Beth Fisher: Or as a listener, maybe you're like, I'm never listening to their podcast again. Think about if you just hang out with someone annoying or if you are mad in traffic, it's not us, so think about the context all the time. But so I think part of it can be scary because it feels like context can change you so much more than you think, but I think realising that can also be super empowering because you get to almost choose how you want to act in every moment in a sense. And I think that's also something that Ajay was talking about in therapy, when we are able to think about our emotions and break them down and then kind of reconstruct them from scratch by going into those kind of basic affect pieces, so that's potentially a strategy that you can use. And I feel like the constructionist view can be a little bit alarming, but it can also be empowering if you can spin it in feeling like you have more of a sense of control than less.

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0:19:55.5 Beth Fisher: So I guess in all these concepts of emotion play a really important role. So how do we learn our concepts of emotion, is this through our language or is this through our emotional experience or is it both?

0:20:08.9 Dr. Ajay Satpute: So I think there's a lot of research to do on that question, let's start there. There's a lot to learn, but it's become a really hot topic to look at, it's been a topic for some decades, but I think I see it increasing in its interest in the community, which is to look at conceptual processes in emotion development and what role they play. And so there's some really lovely work by Jim Russell and also one of my colleagues, Erik Nook, who now we did a more recent study on this looking at children's development of emotion concepts, which words do they use at what ages are they differentiated, meaning, even though you use the words say, fear, anger, and disgust, are they actually different concepts to you, or do they all just lead bad? So what much of this work has found is what's called a label superiority effect, meaning that children are better at matching emotional precepts, like a face to a word than to another face that has the same characteristics. In cognitive science there's actually a lot of studies showing that words actually speed perceptual learning. In a sense, you can use what's called the machine learning, like supervision, you're provided with supervision to guide a learning process that is otherwise inductive.

0:21:22.6 Dr. Ajay Satpute: This can really matter when the statistics of the environment or what you're trying to learn is really loose. If something is really black and white, like cows versus dogs, learning farm animals, maybe you can just be presented with farm animals and you don't have words for them necessarily let's just say in this hypothetical world, and you might very easily start grouping cows together and dogs together and cats together. The question is, would you do that with emotional experiences because maybe they're that obviously distinct from each other, but maybe they're not and they need to be learned. According to constructionist views, they are very fuzzy, very fussy, and so having a word can really catalyse the learning process. I think that's how I think about it, at least.

0:22:03.5 Dr. Ajay Satpute: That language really speeds the development and learning of emotion concepts, and it's hard to know what comes first, I think that it's probably important to have some feelings and then we're trying to make sense of those feelings, like I feel something in my stomach. Is that an instance of anxiety, or is it an instance of my stomach is upset because I ate something bad? So if that's the percept or the sensory input is some feelings from the body, we use context and language to help us understand which one it is in different moments. And so there's some evidence looking at how parents talk to children about emotions and how that might influence their emotion development over time, there's some evidence about this concept called emotion granularity, which is your ability to finally distinguish between different labels, not just like anger, fear and disgust, but something like fear versus terrified versus scared versus other words to some people might seem like synonyms and actually, really describe the same thing.

0:23:05.0 Dr. Ajay Satpute: And to other people, they might say, Actually, no, I wasn't scared, I was terrified. And that's a really distinct experience for them. According to a constructionist view, people learn those concepts and start carving them out, and the people who have high granularity will actually have different neural representations for those experiences, whereas people who have low granularity, it all kind of glum together into a common category.

0:23:29.0 Beth Fisher: With this development in children, do you think we can use this research to inform how we can best help emotional development in children and processing and it's something that we will end up maybe using in schools or these kinds of things.

0:23:45.4 Dr. Ajay Satpute: Yeah, I certainly think that's the hope of this research, it's not my personal field of course, but I think that one of the big tests that needs to be run is whether someone's granularity and emotion concepts, whether teaching people about emotion concepts really helps them. But right now, I think there's a fair amount of evidence that suggests that it will from different lines of work too, which I think speaks well to it, but most of it, I think is correlational, and there's not as much that's causal. It has been shown, for example, that the granularity of your emotion concepts is actually associated with mental health and well-being or the diversity of words that you use to describe your experience, different diversity of emotion words they use might be also the kind of related concepts. And if you have difficulty in being able to think about your experiences as emotions, that also is related with poor outcomes. So I think that there's a lot of correlational evidence, but I'd love to see some great causal studies and they are just really hard to do.

0:24:44.3 Beth Fisher: And I guess the other thing is, when we think about therapy or even when we're trying to help children explain how they're feeling, we do focus on getting them to use more words and all of these things. So when you go to a therapist and you're sharing your experiences, there's always new words on how to describe a certain situation, or this feeling that we had, or how someone treated us. So it seems like that is something that helps us.

0:25:06.0 Dr. Ajay Satpute: Absolutely, there's so many ways that it could possibly help us, but I think that a really important one is just in our ability to socially communicate with others and create a sense of belonging in a community. I think it'd be fascinating in a very weird thought experiment that what if you have a set of emotion concepts and you go to another place where the culture does not share your emotion concepts at all, I think it'd be really weird to think about how to communicate what your experience is like. One of the thought experience I have enjoyed is how much more information we get when you combine an emotion word with a situation word to understand someone's experience. If I told you I went to the theme park and I went on a roller coaster, it's very different than if I told you I went to a theme park, and I went to a roller coaster and I was scared, or and I had fun, or and I was disgusted. It really creates different visions or ideas or predictions of what my experience might have been like to help us connect in terms of what that might be, and similarly, if you are missing the situation, you can have the same problem. So it's like, I went to the theme park, and I was very scared.

0:26:11.8 Dr. Ajay Satpute: It's like, Well, what happened, you're missing some key element there, and not that I've tested this yet, but I'm curious about adding an emotion word with some situational context that really helps people understand you, and if we didn't have those emotion words or if we really just thought about emotion words as development just for an individual to understand themselves, then we can miss out on a really rich part of what emotion words are for. It is definitely there for communicating, and one of the functions is to communicate emotions to others, and the ability to do that can really create a connection as we know through disclosure research with others. But we didn't have that, or if our own words that we use are distinct based on our cultural background, it would be a real challenge, and I imagine alienating.

0:26:56.4 Beth Fisher: Even this language and communication is so important, is there work showing that when we go to other cultures this may be one of the reasons why it can be difficult to connect and all of these things, because we haven't had these shared experiences and we... Yeah, the communication of that might be hindered?

0:27:13.6 Dr. Ajay Satpute: I'm gonna have to go to the books on that one to double check on it, 'cause I think that there's definitely research done by one of my colleagues, done by many, but I think one of the best demonstrations and the most richest demonstrations done by my colleague, Kristen Lindquist, they have basically done language modeling, you can kind of map the space of the words, the emotion words that someone has in a language and culture, and how they're organised around each other in a semantic space based on what other words are commonly used. From that you can look at what are the common emotion words that are frequently used and what is their, the space? What are their closest synonyms? And shock... I mean, I guess not shockingly from a constructionist standpoint, they found tremendous variation across cultures. It wasn't the case that there were shared concepts across cultures that seemed to be universal, the ways that people seem to think about and talk about emotions vary dramatically, such that some emotions are just not represented at all, but are very popular in some cultures. So something like that, I think is a clue that it could really matter.

0:28:18.2 Dr. Ajay Satpute: In my own experience, I grew up as somewhat bilingual as a Marathi speaker and a English speaker, and there are certainly words in Marathi that my parents would use that I learned that were not always easily translatable or sometimes the best translation didn't quite capture the spirit of the word. So I think that there's something there, there's probably some research on it in terms of the relationship between emotion word usage and acculturation, but I don't actually... I think I would put it in at 50/50 right now, but I wish I knew the answer, I'm a scholar, I can only learn so much. And most of my work focuses on neuroscience.

0:28:55.8 Beth Fisher: Yeah, 'cause I think even between different English-speaking countries, like I'm Australian, but I did my undergrad in the US. And even sometimes communicating with Americans, it really felt like there was something that we couldn't fully understand about each other. [chuckle]

0:29:08.5 Dr. Ajay Satpute: Really? Was there emotion things that came up there too?

0:29:12.7 Beth Fisher: Yeah. We just didn't really... I would assume we've been watching all the same TV shows 'cause Australia's very exposed to American culture, but you go there and there's just that something missing, and then when you go home, you're like, Oh, I feel I fully understood.

0:29:24.6 Dr. Ajay Satpute: I think that there's a lot of mileage that we could look at there about how these words are used differently in different cultures, and I feel like, Shit, I had a parallel experience, and I went to Bristol in England for some time, and even though there's so much similarity, there was definitely a feeling of, I'm not really part of this culture, and I don't really know how to communicate effectively all the time, socially and emotionally, because we present differently, we seem to experience differently, even by word, the same emotion seems to be a little distinct or tarnished differently.

[music]

0:30:02.6 Beth Fisher: So I was talking to my friend, we were on a walk on the weekend, and I was telling her about the interview with Ajay. I feel like I always bring up my terrible time in Amsterdam and my great time in New York, [laughter] in terms of communicating with people and maybe feeling isolated because it just was harder to connect with people because of the way we expressed emotion. And I was explaining this to my friend and she started panicking kind of. She was just like, that's crazy, because you have this feeling that there is this universal feeling of humanity, and I think you just assume everyone experiences that, and I think also that's important for us to feel like we experience that because that's how we treat others the way we wanna be treated because we consider that they experience it well, the same way we do. I just found that quite hard to believe. Well, not hard to believe, hard to accept, I guess more that people in different cultures or who speak different languages may be experiencing an emotion slightly differently.

0:31:00.0 Ava Ma De Sousa: This idea that you bring up and that Ajay brought up about emotions and different languages is one that actually dates back to the '20s when there were a couple of philosophers talking about this idea that language can determine how we perceive and categorise the world, so this is known as the Sapir-Whorf hypothesis, but is this idea of how we label colors and different languages. I've had heated arguments with Italians about color because in Italian light blue and dark blue are different colors, so they have different color names. So light blue and dark blue to an Italian person looked just as different as blue and green would to us or to someone who's brought up in English primarily. And so they really don't see those colors as the same color. It's not a differentiate shade, it's a completely different color.

0:31:50.6 Ava Ma De Sousa: This also extends to a ton of other types of categories. So my partner is Spanish, and we've gotten into weird arguments where it will be like a hot summer day in Spain, and I'll say that I want a melon, and then I'll eat a watermelon, and he's like, I thought you wanted to eat a melon. I'm like, Yeah, I'm eating a melon and he's like, That's not a melon, that's a watermelon. Because for us, watermelon, Honeydew melon, they all have that suffix, whereas in Spanish it's a completely different word. To him, it wasn't even in the same category, and it made no sense that I was lumping them together. It's freaky that these concrete things like colors, which is basic perception, something like how we see categories and fruits or vegetables, that seems like something concrete that we wouldn't be able to be messing with with our language, but even that does, and I feel like emotions, which is an even fuzzier concept that I think most of the time we barely understand. It's pretty clear that there would be differences in how we think about those and nuances that we can't share. As Beth and I know in the Netherlands, there's a concept of [0:32:58.8] \_\_\_\_. That's clearly not the way to say it, but...

0:33:02.4 Beth Fisher: I totally... What was that concept? I can't even remember.

0:33:06.9 Ava Ma De Sousa: Wow. Beth has erased her time in the Netherlands.

[laughter]

0:33:08.2 Beth Fisher: What was it? Was it craziness?

0:33:13.2 Ava Ma De Sousa: Well, a Dutch person will probably get into an argument about what it means, but it's like sitting on a terrace and with your friends and having a nice moment.

0:33:22.3 Beth Fisher: I can't remember any of this. [laughter]

0:33:25.9 Ava Ma De Sousa: Sorry to the Dutch people listening out there. Maybe you forgot because it's just something that you didn't feel like you could integrate into your understanding of an emotion. It's not only that we can have these differences in quality, which are scary, but there can even be differences of what we put focus on, because I think that's such an important emotion, an emotional experience for Dutch people, whereas for Americans because it's not something in our language or I'm in America now, neither of us are American, but Jesus, I assimilated that it's not something that we seek out, and that's the same across other cultures too, where we as Westerners tend to want to seek out happiness, positive valence and high arousal emotion, but in other cultures, that's not at all something that they want. They want a moderate kind of more of a peaceful feeling. And so I think that if we fundamentally differ on what we value also like these value judgements of emotion, that can also lead to a huge divide in the way that we are communicating with other people, because it's hard to put yourself in someone else's shoes when you just don't understand what they could actually want.

[music]

0:34:35.3 Beth Fisher: Fair warning, we're about to get into a little methods discussion, but I promise it's not gonna be boring. Specifically, we wanted to know about a really cool new tool that Ajay is using called 7T fMRI. Okay, let's break that down. FMRI stands for Functional Magnetic Resonance Imaging, and you might have had an MRI before if you ever got injured on your knee, or your arm or maybe even your brain. The functional part or the F in fMRI just means that you're not only getting a static image of the brain, but you're able to look at changes in an area over time, essentially like a brain movie. So things are happening in the brain that influence the tissue, and you can create a sort of movie of the activity happening there. So that's fMRI. But the way MRIs actually work is that they're basically a giant magnet, that's why if you've ever had one, you have to make sure that you have no metal on you when you go into the room. And the strength of magnets is measured in a unit called Teslas. Most MRI machines in hospitals and universities are at a strength of 1.5 Tesla or a 3 Tesla. For comparison, junk yard magnets that lift cars have strengths of one Tesla. So these are very strong magnets. Now, Ajay has started using 7-T MRI for his studies. So a magnet seven times the strength of a junk yard car lifting magnet. And we wanted to know what this insanely powerful tool could mean for effective neuroscience.

0:36:02.8 Dr. Ajay Satpute: So when MRI technology came out in the 1990s, there was tremendous excitement, most of that excitement is because imagine prior to that, much of neuro-science was studies in non-human animals, were invasive and they tended toward focusing on structures that were more discrete and traceable starting from sensory systems to motor systems, but the middle stuff, which is cortex, was very difficult to study because when you look at cortex, it's just a big gray sheet, it seems continuous. Whereas if you look at certain parts of the brain, like the brain stem, there's discrete nuclei, you can sort of carve it out and say, I'm studying that thing, but with cortex, it was hard. So that was one thing that neuro-imaging allowed us to now look at cortex globally, all of a sudden we can look at the whole brain every two to three seconds, we get data on it, very different than putting in needles in one location recording for a while putting in needles into the next location recording for a while. Very, very different. Like scale-wise, completely revolutionary. For a long time, I think that because of that reason, and also because you could finally study things that we know humans do that we're not clear about what non-human animals do, things like imaginations and subjective experiences, and the sense of love and all of these things.

0:37:17.8 Dr. Ajay Satpute: And language, I can keep going. But we could finally study things that are really hard to study in non-human animals. When imaging came out, I think that there was a big focus on cortex and pretty large sub-cortical structures like the Amygdala and the hippocampus, but the brain stem was more or less ignored, relatively speaking, because the excitement was all in these other areas. But now I think that as we've come to learn more and more about neuroscience, we're seeing that small nuclei and brain stem nuclei and also just in general, sub-cortical structures have a rich dialogue with cortex, and that understanding ultimately what human cognition is about will involve all of that, we can't study cortex in isolation from sub-cortex. So I think that there is one theme there.

0:38:03.4 Dr. Ajay Satpute: The next theme is that sub-cortical structures, especially brain stem ones are small and very hard to study using conventional three-Tesla imaging, in effect, we weren't looking at individual structures down there, we were looking at averages of many structures, and that's a problem because these structures do have functional distinct differences, that's also an impetus for why seven Tesla is really great. But I think that the neatest reason is probably because of its value for emotion theory and emotion research. We talked earlier about the basic emotions theory and certain systems that seem to be important for defensive behavior, or they've also been referred to as survival circuits that involve these sub-cortical areas. And one of the areas is the amygdala, another area though is the periaqueductal gray in the brain stem and other areas like hypothalamus. And these are all pretty small and let me just focus on the periaqueductal gray, which is called the PAG. This structure in the brain stem is so cool because it basically receives lots of information from different sources, but it coordinates with that information, defensive behavioral responses. And so there's some seminal studies showing that if you stimulate parts of this tiny, tiny structure maybe 12 millimetres tall and 6 millimetres wide.

0:39:15.0 Dr. Ajay Satpute: If you stimulate one little piece of it, you'll find that a cat will engage in some kind of attacking-looking behaviour, and if you stimulate another part of it, it will move away, and so it was thought to be sort of a fight or flight system there, then if you stimulate yet another part of it, it seems as if the animal will sort withdraw from the environment and just go shut down and recover. This is really beautifully done work, some of this has been argued as the foundations of emotion, but we haven't really been able to study whether these structures, that particular structure in fact, how it plays a role in human experiences of fear and anger and sadness and disgust and joy or any other emotion.

0:39:57.1 Dr. Ajay Satpute: And so while there's been theoretical models that have been arguing that the structure is very, very important for subjective experiences of fear, in particular, that maybe fear is in one part and panic is in another part has been argued, maybe low grade fear or anxiety is in yet another part, people have made certain arguments there with the structure, we haven't been able to test that in humans. For me, it's really exciting to look at the structure, examine in part, what role does it play in emotion, does it actually carry information about subjective experiences, or is it really just about an area that is really important for survival circuits and maybe even more generally, just autonomic control, preparing the body for different types of behaviors, regardless if that behaviour is also occurring in an instance of anger versus sadness versus disgust. I think that's definitely one of the reasons why I'm really excited about it.

0:40:50.2 Beth Fisher: Is there any new stuff that you're working on and anything exciting that you'd like to share?

0:40:56.9 Dr. Ajay Satpute: Yeah, there's tons. So I'll just give you a little sampling of some stuff and if you're curious about any of it, I'm happy to chat about it. There is a line of work that my lab has generally been interested in, which is how does language shape emotional experience and so based on the words that we use, or learning certain words in certain context, will that change the neural representation of emotion anyway. Another area that I'm very curious about is solving a problem for constructionist theory, which has been, look if what constructionists are saying is that fear doesn't have an essence to it, that there's different neural patterns for fear in different situations, and there's nothing necessarily common across all of them even, then why do we have one word for it, why do we have this category called fear, why don't we just have different words like that instance in which I'm standing at the edge of a cliff could be called something else, and the instance in which I'm scrambling away from a spider could be called something else, but we seem to use one word to describe, a very heterogeneous variety of instances of that emotion. The basic emotions view solve that problem by arguing that there was a common circuit or a common physiological output or a common facial expression, whichever it is.

0:42:16.5 Dr. Ajay Satpute: And as constructionists have chipped away at those ideas, that commonality does not seem to be as common, I think that it's left this gap, which is, why do we have the same word for all of this diversity of experiences, like why do they have a common umbrella? And so I've been working with my lab on projects that are looking at what we call emotion abstraction, which is the ability to abstract across many different instances and describe them with a common word, which I think is a conceptual process, it's been mentioned that when something does not have a lot of obvious statistical regularity in the environment, we can use conceptual systems to actually lump things together that don't necessarily belong together in any obvious way, based just on perceptual qualities.

0:43:08.8 Dr. Ajay Satpute: One example is things that you would grab if your house is burning down, that's like a category of things, but maybe someone would grab a photo album, although now everyone has their photos on their phones, so maybe just their phone, their pet, and I don't know, maybe that one other favorite thing of yours, like your guitar, under what other conditions do those three things go together, there's nothing statistically common between them really, and so it's a conceptual category.

0:43:35.7 Dr. Ajay Satpute: The argument is that emotions are conceptual, the sort of category fear is a conceptual category. We've been running experiments to look at this process of abstraction, and in particular, whether this process of conceptual abstraction or conceptual processes and emotion play an important role in mental health and well-being, since most of the work I think that looks at emotion and well-being is trying to get at affective feelings, but not necessarily how people think about emotions as much, and so language and conceptualisation and abstraction, I think these are pieces that we don't understand quite as well that could play a big role in mental health and well-being.

0:44:15.9 Beth Fisher: Would the theory may be that people who abstract more... I don't know if that's how you can phrase that, but they would have poor mental health, would it be something like that, because they have your concept?

0:44:28.0 Dr. Ajay Satpute: That's... You know, I think that actually, our prediction was a little bit the opposite, but I see where you're going with that, 'cause I think that there is a tension, there's definitely a tension, one that we have to work out, which is that on the one hand, if you have more precise categories to describe your experience, then that might actually fit better, it's like being a bird watcher, the more expertise you bring, the more, instead of just saying, "Hey, there's another small brown bird," you actually call it by a certain name and you have knowledge about it and that really shapes your understanding and maybe even perception of that bird, that's what it means to be an expert, is refinement of categories. So I do think that that's the case with the emotion too that with practice and training and maybe people like actors or therapists get really, really refined categories for what they mean by certain words, but I also think that there is a part that goes in the opposite direction, that's also important and functional, and it's really the flexibility, and that opposite direction is, if you can abstract then you're able to generalise information from one domain to another, that's in part the value of it, and if you're unable to, then every instance of life is as if it's totally fresh and without any ability to use prior knowledge and context to help you traverse that instance in a way.

0:45:45.0 Dr. Ajay Satpute: So I do think that there's some value to emotion abstraction in that sense at least, but I can tell you also that our initial work on this shows that people who are better able to abstract and notice or think about fear of heights and fear of spiders are sharing something and sharing the concept fear at least, people who are better at doing that also seem to have reduced alexithymia, reduced autism spectrum scores on an autism spectrum quotient and reduced depression. So I think that there is something there, but it's really at the beginning stages, so...

0:46:19.9 Beth Fisher: Why would we have this ability to have this abstraction? Is it so we can be flexible in different situations and that's better for us? Would that be the main driving reason we would do this?

0:46:32.1 Dr. Ajay Satpute: I think so. I think that conceptual flexibility is really important, one of the things that always stuck with me is I used to read philosophy as part of my lab group, and there is a philosopher Merleau-Ponty who talked about this notion that's called maximal grip, and the idea is that the world is inherently uncertain, ambiguous, and noisy, and we try to grip it with our minds, if you will, and it's like a metaphor, of course, but the way that we grip it can be different depending on the concept that we use, so you can describe an action as I'm lifting a glass, you can describe an action as I'm quenching my thirst. You can describe it as I'm wrapping my fingers around an object, each one of those is a description of an action, but some of them afford a lot more flexibility in certain situations than others.

0:47:27.2 Dr. Ajay Satpute: If it's described as I'm trying to quench thirst as an abstract way, there might be many new solutions that one might think of, you don't just have to grab that glass of water, you might grab a hose, you might jump in the shower and like open your mouth, and those would all count as quenching thirst, but if you conceptualise that as another level like I'm grabbing a glass, that could be for the purpose of quenching thirst or it could be for other purposes, it could be to throw it at someone, but you also have a very concrete idea of what you're doing in terms of behaviour, and then you can get even more concrete with I'm wrapping my hand around an object in a sense gets that visceral sense of feelings in the fingers and in the palms and in the thumb, and the orientation of the hand, and so we've done some work on this showing that actions can be described along a hierarchy of more abstract and more concrete, and I think that the goal in terms of flexibility is that you wanna find the level that seems right. At times, that just happens naturally, it's not that one level is always right.

0:48:26.2 Dr. Ajay Satpute: If I were to give you a mug of coffee and you were to drink it, you might say, I'm having a mug of coffee. Now, if I made that mug of coffee 15 pounds, you might just say, I'm trying to lift the mug, which is a more appropriate description of what is happening, even though it is more concrete. If I gave you a one pound mug of coffee, you might say I'm having coffee, this more subordinate action description of lifting is not a part of that equation, but one of them seems to account for experience better in one case versus the other, because of the challenges that you're facing, so I think similarly, abstraction might give us some leverage to generalise our experiences in ways that are important, but depending on the context, and similarly zooming in or focusing on more elemental pieces can be really great.

0:49:10.7 Beth Fisher: Yeah.

0:49:10.9 Dr. Ajay Satpute: And so I think that on that account, people have started exploring therapies arguably from a constructionist perspective, where what you do is you take your emotional experience and you might think of this as terror, but then you just try to deconstruct it into its elements, like what is happening in your body? I feel some energy in my limbs, I feel a sinking sensation in my gut. Can you reconstruct it in a different way such that it's no longer terror, sort of like using Lego blocks and reconfiguring them into a different object, so I think it's flexibility that matters and I think that we just know very little about abstraction, we don't know probably anything about it, in fact.

0:49:52.4 Beth Fisher: Yeah, so abstraction of my feelings could be good in terms of flexibility, but in terms of interpreting other people's feelings, that could probably be negative, because if you just put everything together as fear, you're not really understanding people who are emotionally intelligent can not just lump everyone together and get the nuances of people's feelings, so I was just thinking like maybe abstraction for our feelings are good but when it's other people's feelings, it's not so good.

0:50:17.8 Dr. Ajay Satpute: Yeah, so that's a great question. I think also there flexibility matters, and I understand what you're suggesting, and I think that it's something that we'll have to figure out about the functional value in these cases. I don't think that people are... When they're abstracting, like when they're perceiving others are spontaneously saying, you're feeling fear now in this instance with the spider as that time when you felt fear when you were with in the heights right, but in some ways, there might be some similarities. There might be featural similarities and that I might use to infer some common pieces, maybe in both cases, they froze, and then I would be able to use that one instance in which I saw that my friend was frozen at the edge of a cliff to look at them now, and see that they're freezing now and say, oh, maybe if I couldn't retrieve that other instance of memory, then I would just see them as freezing and I wouldn't have any generalisation of that and it would mean nothing to me, it would just mean a new thing I have to learn, and so there's some possibility that it could generalise, but I think that in practice, I don't think it's necessarily a conscious process, I just...

0:51:24.3 Dr. Ajay Satpute: We have an instance that we're presented with, and to the extent as we can, we'll draw on our prior memories to help us understand what's happening here, and if I have a knowledge that you are someone who's afraid of spiders from prior instances, and I see a spider is there, I may not need to call on some really wide ranging [0:51:44.1] \_\_\_\_ [chuckle] instances to understand what you're doing, and it might not make sense for me to do so, except for the purposes of humor maybe, so in that sense, I think what Merleau-Ponty has argued is that you gotta find the right level to describe what's happening such that you have the best grip over the situation, meaning you know what predictions to make, you know how to engage with it, and you might go too high or you might go too low, so I agree with you that it doesn't totally make sense to draw on very different situations and in which you felt fear to understand the current one, but I think that abstraction might occur at different levels, getting more concrete might occur at different levels, and if you think of it more as a continuum, where even instances in which you felt afraid of a spider, they're all different from each other too, and that is a process that requires some degree of abstraction to bring them together and say there's something common here.

0:52:31.4 Dr. Ajay Satpute: For that matter, there might be many instances in which you're encountering a spider in which you behave differently, but still feel afraid. And so there's some element of abstraction there.

[music]

0:52:44.0 Beth Fisher: Back to the categorisation of colors all because color is a continuous spectrum, but when we report on them, we report them in these categories, so we say red, blue, green. When Ava was speaking about the Italians, are they actually seeing the world differently to us, or are they just reporting on it differently, and that's still one of the million dollar questions. No one knows the... There's research showing evidence in both ways, and I think that you can apply that to emotion too. But yeah, it all gets tricky and confusing and you can start to panic about what really is reality.

0:53:17.8 Ava Ma De Sousa: Yeah, and I think that idea of the subjectivity and that phenomenological experience that we often, I think in psychology, try to move away from because we do have this physics envy where people will sometimes make fun of social psychologists, like we're not really doing science, and I think because of that you can see that in a lot of psychologists, that they feel like they need to prove themselves and therefore, they have to completely remain neutral. We don't wanna talk about subjectivity, and I think one of the most interesting aspects of what Ajay was saying was that we've lost so much doing that because it's almost like this throwback to behaviourism, which was a movement in psychology in the 20th century when we didn't believe that there was anything like an internal life that could push anything forward, it was just about a stimulus and a response, like a behavioral response, because we've taken this idea of this fear circuit and these instances that we call fear, and we don't even talk about how there are different types of experiences that could all fall under fear.

0:54:13.8 Ava Ma De Sousa: That apparently, according to Ajay, don't even share a neural signature, but clearly there's something that is subjective that's linking all of those things together, which I thought was really interesting and also kind of disturbing in the sense of being a psychologist, and if we're seeing that there's no physical basis for these things being the same, there's just this conceptual linking of it, and we're operating under the assumption that as scientists we're going to be able to find everything about the mind in the brain, right, physically, that's what we're doing as scientists, that if that's not there, then what is this ephemeral thing that's grouping all of that together and calling it fear. Shouldn't there be something that is all the same? So I thought that was really interesting and really scary.

0:54:55.0 Beth Fisher: Yeah, 'cause the stuff we spoke on at the end about abstracting emotion and then the implications that this can also have for mental health, and maybe if we can start considering this in different ways that are kind of similar to the ways Ajay was talking about that could be really beneficial, 'cause compared to a lot of traditional ways of viewing emotion, it's a totally different approach, and I think that maybe that's something that we've been missing that could help people who are struggling interpreting certain events or communicating to others or things like that.

0:55:31.6 Ava Ma De Sousa: Thank you to Dr. Ajay Satpute for sharing his research with us this episode. Our intro and outro music is 'Nobody Stayed for the DJ' by Glassio. Our transition music is 'Back for More' also by Glassio. Minds Matter is mixed, edited, and created by Beth Fisher, she's the Australian one, and me, Ava Ma de Sousa. We'll be back in two weeks with a brand new episode of Minds Matter. In the meantime, find all our episodes and show notes on mindsmatterpodcast.com.