# Week 1 lecture 1

Okay. Welcome. Yeah. Go ahead and find the seats. Welcome. Welcome to Psychiatry, 79. If you happen to wander into the wrong classroom is the opportunity to leave? No embarrassment. Good. Everyone's in the right place. It's hard to find. So you had to battle your way here. As you can see the classes, I'm excited to have you all here. If you're on the wait list, did PT's this morning or if you were on the wait list previously, you can contact your TA. If that doesn't work out or something, we'll go over the specifics. But yeah, I'm excited to teach this in person. There all the covid issues and then last year we started in person and there's a flood in this classroom and shutdown. We had to go back online. We had like the plagues. The flood just waiting on the rest of the plagues. Okay, good. Everyone's here awake. Okay, so I'm just going to start with the big takeaway for this class right up front. And this is the only thing that you learn. Whether you dropped this class or 20 years from now, is the only thing you remember from this class. If you just learn, this will be really valuable. Which is that simply by making small changes in your thoughts, your actions, your interactions, and your environment, or your surroundings, it's possible to change the activity and chemistry of key brain circuits that contribute to mood, motivation, stress, resilience, sleep, all of that stuff. If you remember that you're set for life, the challenge is knowing specifically which actions are most useful or which changes in your thoughts are most helpful for your unique brain at any specific point in your life. That is something that you can't really research on other people. To answer, you have to use your own investigation of yourself, you understand yourself better, and figure out how to apply these things to your life. That's one of the primary goals that we're accomplishing in this class is understanding like, oh, how can we take all this amazing research out there that's so cool, and actually figure out how to apply it to your life. I suppose I should introduce myself. I introduced the topic first because I assume that's more of the reason you're here. You're interested in the material, but hopefully I'll be interesting as well. I'm Dr. Alex, or I have a Phd in neuroscience. I started well, I guess I've been interested in the brain for a long time. I just always been fascinated by why people act the way they do, or why I acted the way or felt certain things. Or when you have a clear idea of like, hey, I'm going to do this, I'm going to study and then go to the gym, and then whatever. You don't do that, but you really feel like you want to do that and you know what you want to do. And yet somehow it doesn't line up like why. For me, the Y was best explained by understanding the brain. And I just happens to major neuroscience, mainly for two reasons. It sounded interesting. People seem more interested in you when you tell them you're majoring in neuroscience. And that's a big, well the other was, the guy across the hall from me was majoring in neuroscience. And he was like, what are you majoring in? I don't know it like we come to the major in neuroscience with me. I was like, okay, great. But the more I learned about the brain, the more fascinating it became. And also the more I could understand myself and why I would get stuck in bad habits or feel the way I did in certain situations. Ultimately, after I graduated, started working at the Brain Mapping Center here at UCLA doing neuroimaging. Research now was super cool. We'll talk about various kinds of neuroimaging. My boss convinced me to go get a Phd, Also got a Phd here at UCLA doing research on depression and trying to figure out there's got to be something we can measure about the brain that would say, oh, you're super depressed and you just need to snap out of it or something. We'll go into that more definitely a complex process and I learned a lot about the brain. But one of the things that, that led me to is wondering like, oh, I don't just want to measure the brain. I want to change the brain and help people find the part of their brain that, let's say you find the part of the brain that's not working quite right. Could you stimulate that to get it to work right? And that's when I started doing neuromodulation research in my post in my postdoctoral fellowship, studying how we could use this new brain stimulation technology to actually change these circuits. Progress in that was really slow as scientific research is, but also because it was applied to humans. We had to, and it was potentially medical applications, we had to deal with the FDA and that slowed things down. The research was so interesting, was very frustrating. I realized like part of the reason I felt so frustrated is because I was focused narrowly on developing this new technology which believe would be helpful. But eventually, at some point, like ten or 15 years from now, from all of this background research I had done in neuroscience, I realize, oh, thinking about this concept of neuromodulation too narrowly, yes, you can use some high tech beam to stimulate the brain, but there are so many simpler ways to change the activity in chemistry of key brain circuits that don't involve high tech devices developed in a lab. It's just that a lot of these things like exercise or sleep, or social interaction, we easily dismiss because you're like, no, but I want sockets ultimately. That's what led me to write this book, The Upward Spiral, which is about mainly explaining why your brain gets stuck in certain patterns like depression and anxiety. Then what you can do about it. And why simple life changes like exercise or gratitude, actually change the brain, often in more targeted nuanced ways than these high tech interventions developed in a lab. Which is not to say we shouldn't have high tech interventions. We any intervention has a limitation. And there are some things that only a Dr. do for you and only a Dr. should do for you. There are some things that you can do for yourself. Just like if you're taking care of a car or your car, there are some aspects of the car that you should probably take it to a mechanic. Like the engine stops running, you need a new transmission, or unless you're a super expert, you should probably take that to a mechanic. But there are some things like putting gas in the tank or keeping track of your keys so you can turn it on. Those are things that you so do, because if you just rely on someone else to do all those things, well, then you're going to be going to mechanic a lot. It's crucial to know what are those things that I can do on my own to deal with my specific car and what are those things that I have to take it to someone else. If you get that wrong, then you're going to create more problems then you solved. This is the textbook for this. They asked me to create this course mainly because they're like we want to teach students helpful skills, but it has to also fulfill their life sciences requirements. You got to make it science. Can you do that? And I was like, that's my jam, like making things seem science. Like I can do that. They're like you thought of textbook that they're going to use. I don't know, like most of the textbooks, they're too expensive or they're just too abstract and they have you thought of using your book? And I was like, no, because I find that sketchy when professors assign their own book. But it's really helpful. And I was like, I agree with you I finally let them convince me because you can get it for $12 an Amazon. Better than whatever other expensive textbook I could have assigned to you as I play and I coach ultimate frisbee. If you have any questions about ultimate frisbee, how to throw differently, catching fit, I'm happy to answer those partially. I say that as a joke, just like include that in there, lighten things up. But also to let you know that I too am a human with multiple interests and life commitments. I recognize that you have. Yes, you're probably interested in doing well in this course, but you have all the other things going on in your life. Sometimes we like to think, I can only ask a specific question about this class, but I am open to talking about whatever other challenges, even if you feel like they shouldn't impact your ability to succeed in this class. If they are impacting your ability to succeed in this class, then I'm happy to talk with you about that. I think perfect sense also for this class because this class is at applying this information to your own well being. That being said, if you're interested in playing ultimate frisbee, you can join the team. Contact information. Often we have a few people show up, but it's fun. Yeah. Practices are about to start. Hope to anyone, they'll teach you. I should say also this beginning part of this lecture is not something you need to take notes on. But if you need to spell frisbee, there's two E at the end. Don't forget, I remember this one class I took in college, City politics. Irrelevant what the topic was, but I remember the professor took most of the first lecture to be like, hey, don't take notes. I'm just going to give you an overview of what this class is about. Like an overture, orchestra. You understand like, okay, where are we going with this? To provide context which is so much more helpful for learning information if you understand how to place it. Because otherwise you just end up trying to memorize everything I took that I was like, oh, I was brilliant. I'm going to steal that. This first half of the lecture is an overview, an overture of what we're going to be talking about and focusing on in this class. You don't need to take anything from this that I mentioned that may be an exam later. I will specifically mention later, I'll let you know when yeah, you can start taking notes, but the primary goal is to okay, understand. Sometimes writing too much gets in the way of understanding and also to be interested. Are you interested in this If there are other classes you could take, there are lots of people who are interested in this, who want to be here. You don't think it's interesting or you don't think I'm interesting. I won't be offended, but this is the best way to find out. I'm going to start with a few snapshots of studies that shaped my thinking on these ideas. I'll share some of them with you. These are some of the things that got me excited more about the neuroscience and the possibilities, and maybe you can have that same or similar perspective. These three vignettes happened in grad school. In the first has to do with yoga. I remember I joined this lab studying depression. It was run by two psychiatrists. Almost all of the studies that they were doing were focused on medication. We would do EEG's, which are electrical recordings from the head to look at different parts of the brain. And they were trying like diagnose people with depression or different kinds of depression. Or say like, well, oh, if you got this medication, how did your brain change? Or trying to predict who would get better on which medication. And one of the things that they found is like that, you know, it's really hard to predict who gets better on which medication. But in general, medications were fairly helpful for people with major depression. But it didn't, it wasn't the answer for everyone, and so. They would. I think the research, on average, about 40% of people with depression on the first medication you give them for like three months, 40% of people will get completely better. They'll be no longer depressed. That's like amazing. Something as complex as human depression, like you just give someone a pill and just wait a few months and it's gone. Another 30% get significantly better, a lot better, but still depressed. Then another 30% really helped much at all because they were using medications to study all these things. And we just bringing people in through this pipe line, they had a lot of people who at the end of all these months were depressed or still super depressed. One of the psychiatrists is like, hey, why don't we try something beyond medication? Not because the medication isn't helpful, Medication is helpful, but we have all these other people who weren't helped by the medication fully. They stuck, it is small study, They stuck them all in a yoga class three times a week for a few months. And what I noticed when I first joined the lab was this scientific poster that showed the data. And there were only like 13 people in the study, but they had all failed to get past their depression on many months of medication. And yet on just a few months of yoga, 12 out of the 13 got completely better. And I was like, oh my God, this is amazing. Like this is the answer. Like you need to prescribe everyone yoga. The psychiatrist in charge was like well, like, yeah, it was really helpful but it wasn't well controlled. Like we didn't know And I was like, what do you mean by that? And he's like, well everyone got the yoga so we don't know like would they have just gotten better on their own? And even if it was the yoga, like what part of the yoga, was it the mindfulness or the breathing, or the stretching, or the exercise? Or just the fact that they had to leave their house to go to the yoga class. Or the fact that everyone in this class was also suffering from depression. So was it like a support group for each of these things that he mentioned? Based on all of the research, the background research that I had done about breathing and exercise, meditation, and social interaction, I was like, well, yes, yes, yes, yes. And that's where I realized like, oh yes, that's why it's a terribly designed scientific study. But that's why it's also crucial to understand when applying research, what is your goal? Is your goal to try and isolate one variable so you can figure out the mechanism of like, how is the yoga working and actually understand the brain better? Or is your goal to use this information to actually get less depressed? If you're a scientist running a laboratory study, it's super important to isolate those variables one at a time to understand how this works. But if you are a person who is depressed and wants to not be depressed, then matter really, whether it's the breathing or whatever or these other things. Some of it just matters like oh, I can't do yoga. Oh well you can do a modified version or you could do some of these other things. It started to help me understand like yes, there are many different aspects. Sometimes when we try and apply science into our own lives, that complicates it a lot. We should stop looking for what's the one solution, it's going to fix everything. Instead we should start looking for, oh, there are dozens of different things you can try this, could try that cold, try that. But it's a very different approach. And this is often taken when you go see a Dr. because they have to write something on the prescription pattern. I do this one thing, but you have a lot more access to you through your whole life. You can try lots of different things. This next story is about. I remember overhearing a conversation between a couple of the other nurses who worked in the lab, and one of them was describing one of the people in the patients who had come through as having empty man syndrome. I was like, oh, that sounds interesting. What is that? I was like, I but in I was like, what? Sorry. You know, I'm new to the lab. Like, is that some diagnosis that I missed? Like, what is that? And she was like, oh, that's just a term that I came up with to describe a lot of the patients that we get in this lab. Like they're men in their '40s or '50s, and they're, they're either unemployed or they don't like their job. And they're either divorced or they're never married. And they don't really have a lot of friends or any friends, and they don't really have any activities that they enjoy. They're super depressed. And I was like, well that's a criteria for being admitted to a study like everyone here is super depressed. Like why did you come up with a specific term for them? And she was like, well because they don't usually seem to get better. That struck me as really important because as I said, of the studies, pretty much all of the studies in the lab were focused on medication. It's not that medication wasn't helpful. It realized there was a limitation. That it was a bit much to expect that something as complex as human depression could be entirely solved for everyone by taking one pill one time a day. Because there are many aspects of these men's lives that were pushing them down into depression. Just taking a pill, while it might make them say more receptive to the positive parts in their lives, all of their lives were depressing, then their appropriate response is to be depressed. Well, medication would be useful tool, it wasn't going to solve all of these different issues. A reverse aspect of what I realized from the yoga study, while yoga study is show, there are so many different things that will help support you or make positive change in your life. There are also so many aspects of your circumstances, some of which are under your control, some of which aren't that are pushing you down into anxiety, into depression. Even if you can't control them, it's still helpful to become aware of what they are. Then it came time for me to write my dissertation because you can't waste time forever in a Phd program. Although it's very easy, you can waste a lot of time. I wanted to see which brain regions we're measuring electrical activity from the scalp, and we could use the software to try to figure out where in the brain those signals were coming from. Now it's like there's got to be something that we could measure that would say, oh, you should take this medication or you're not going to get better in this medication, you should take therapy instead, or you need to get a job or something. What we found was that a couple regions predicted treatment response to some extent before people even started medication. You just measure their brain. Well, we wait three months to see who gets better and who doesn't. We go back three months earlier to when you did the measurement. You see people who eventually got better had higher activity in these two regions, the anterior cingulate cortex and the medial prefrontal cortex. We'll talk about those a lot throughout this course, so you don't need to write them down now. But the point was like, wow, it's cool that activity in these regions predicts who's going to get better. But it was really small predictive ability like people with the highest compared to people the lowest act did at 25% better over three months. Instead of getting 42% better, they got 56% better or whatever it is. That was like the highest versus lowest, and most people were somewhere in between. But it was like, oh, it's cool, you can measure something about the brain. That's what pushed me into study neuromodulation was like, oh, well what if we could stimulate that part of the brain? We could improve people's treatment outcomes. That's when I realize like, oh, I'm thinking about this too narrowly. There are dozens of ways to change the activity and chemistry of these regions. From gratitude to exercise, to social connection, to reframing your thoughts and all of these things. Some of those answers like, oh, you should just do things because they'll make medication more effective. Or maybe if you just do all these things that you don't need to take medication. But it's helpful to have a framework for understanding like, oh, what are the things that you can do on your own? And what are the things that you need to go seek help from someone else for that insight, which we have a remarkable capacity to change the activity in chemistry of our own brains, that simply by making these positive life changes, we can cause positive brain changes. I didn't come up with this idea of the upward spiral was first popularized by this psychologist Barbara Fredrickson. The concept has been around for a while, but she is the first one published on it. About the psychology of well being. And she described it as this idea that positive thoughts and positive actions tend to lead to positive emotions. And positive emotions make it easier to take further positive action and so on. And I agree with all that, but as a neuroscientist and someone who wants to understand why what's happening in the brain that makes that happen. I like to describe it as this idea that positive life changes numerous different things, that we can talk about specifically what they are, but these lead to positive brain changes, chemical composition and communication with various neurotransmitters like serotonin and dopamine and nor penephrines, electrical activity. Even its ability to form new neurons and new neural connections. These positive brain changes make further positive life changes more accessible. That's the concept of the spiral. You also have things that are happening in your life, either big circumstances or specific events that cause other brain changes that make it you're more stressed out or more anxious. And that is also happening. But some of these things that you can't control, the only thing you can reasonably do is, oh, become aware of them. And then in your own actions or thoughts, change what you're doing to better adapt. That's a bit abstract. So I'm going to share three snapshots of scientific studies to illustrate more specifically what I mean. These are also in, I think, the first page of the book that'll make your reading faster. In this first study, researchers at the University of Wisconsin conducted a functional MRI scan of married women. We'll talk more about functional MRI is, but they stuck them inside this big magnet to look at a movie of their brain. They could see what was happening in their brains while they administered a series of electric shocks. Don't worry like they're volunteers. They had to sign a waiver. They knew what they were getting into. They probably got paid more than the graduate students who had to run the study. They put her in strap in electrode to her ankle. They also gave her computer screen to look at so they could let her know when she was about to get shocked because they weren't actually interested in what happened when she got shocked. Like that research has been done for a long time. What they wanted to know is like what happens in a few moments when you're sitting? Intense apprehension and you're like, oh, oh no, I'm about to get shocked. Oh, it's going to happen. A predictable set of brain regions lit up. One is responsible for worrying and detecting danger. Then they repeated the experiment, this time bringing the woman's husband in to hold her hand. They were just trying to control for lots of variables. People have all different kinds of relationships, people have different gender identities and expressions that okay, like we can't study everything. And we're just going to try and control for this one aspect, which is why they specifically chose great married women. They did the same experiment, still got the same shocks and the same warning that their brain response had changed with the activity in these worrying and danger circuits having calmed down. This image shows the regions that had significantly less activity during the handholding conditions. These are the only parts of the brain that are involved in this. Your whole brain is involved in the whole thing, But specifically when we compare statistically what their brains were doing without the hand holding versus during the hand holding, these regions has significant reductions in activity. The acronyms, by the way, stand for the Dorsolateral prefrontal cortex, which we'll talk about a lot in the ventral anterior cingulate cortex. One thing I noticed that stuck out to me was like, oh, this is really close to the region of the anterior cingulate cortex that I had found predictive of treatment response in depression. We're not going to get into all those details. Now, the question, well, there's a lot of questions that could come up. You might not have any questions. That's fine. Sometimes we think we don't have questions because we just ignore our own curiosity. But one of the questions you might have or thoughts that might pop into your head is like, what seems dumb? Yeah, she got shocked. And then she did the same experiment again and she was less anxious Is anything to do with some dude holding your hand or not. The scientists knew. It's rooms. On one side of the hallway had windows that were bright and sunny, while the other side stared straight at a brick wall. So they went around each room with a light sensor to measure the amount of light. And then they went back and looked at the, sorry, I'll illustrate one side versus the other. Forgot to click on that bright window, brick wall. They went around and measure the light. They also looked at the patient's charts, medical records, to see well, how much medication, how much morphine did they need to control their symptoms while they were in the hospital? And they found that on average, patients on the Dim side needed about 4 milligrams of morphine per hour to control their pain symptoms. Well, patients on the right side needed about 25% less, with the sun being equivalent to about a milligram of morphine per hour, which is a lot. I'm not an expert on morphine, but I've read about it. We know from other studies that sun light helps the brain to produce its own form of morphine, which is called endorphins. In fact, the word endorphins come from endogenous morphine. Because we knew about morphine before we knew about endorphins. That also highlights that any one scientific, we know that part from a totally different scientific study. Which highlights that from any one study you can't learn very much. But if you can put a bunch of things together, then you can learn something interesting. This also highlights a key aspect of the upward spiral, which is that we're looking for this one big thing. What's going to stop pain? What's going to solve depression? And we're looking for this one tool to solve everything. But trying to find the one thing that's going to fix everything often keeps you stuck. Because often the most powerful solutions are like just the little things that don't take a lot of time or effort. That you can just open the window. That'll solve a lot problems because it'll make the next change easier. And the next, that gives you a flavor of what we're going to be talking about. I also want to take a few moments to go over some of the details of this class. By the way, I know it's a big class, but if you have questions about something, you're confused about something, go ahead and raise your hands. This is one of the benefits of having a live lecture, is interaction. If you're understanding something, happy to explain in a different way. Sometimes when you're like, everyone else probably gets it. Well, if you're confused then don't just make the assumption of like, oh, I'm dumb. Everybody else is smart because everyone else is probably having the same assumptions. And oh, that assumption, it's probably just a habit that you have this caused by certain connections your brain, that's okay, you have the habit, but sometimes it gets in the way of you just asking a question. I just want to invite you to ask questions because that's one of the, um, goals of this class, is to understand how all this stuff fits together and how you can utilize this stuff. If you don't understand it, then you're responsible for letting me so I can try and help you. Some of the goals of this class are just to learn how stuff and how the neuroscience works and how your brain works on an academic level. Another goal of this class to you think like a scientist and to think scientifically about things so that you don't take stuff at face value. Okay, sure, I'll do that. We want to be able to think critically about information and to be able to understand, well, how do I know what is true and how do I know what is relevant and so on. But then I think one of the unique aspects of this class that students are sometimes confused by at first is that we also want you to then use the skills on yourself to actually help yourself be more productive or happier, or whatever it is that your goals are. This, I think makes it slightly different from most classes you take because it would be like. I don't know, a business by class. And then them saying, oh, as we're going to do your taxes in class, there's a practical element of this, that's the applied part of the positive neuroscience. So you're not just going to learn about this, you are going to learn about it. You're going to apply it to your lives. All the slides are posted on Brew. The assignments are posted on Brew Learn. That's where you'll have most of your stuff that you need. There are some little videos sometimes that are part of the readings. Most of it is readings either from the book or journal articles. I think it's important to actually read some actual science like sciences reported in scientific journals. You learn how do scientists write and communicate about these things. However, I realize this is an introductory Life Sciences class. I'm not going to try and memorize or understand like the whole journal article usually, I just want you to read the abstract, which is the first 400 word summary of what they did. Sometimes we'll ask you to read a little bit more of the articles, but make sure when you look at the syllabus you see like, oh, do you have to read the whole article? Or just like the abstract, when we ask you to read the article, we're not trying to get you to memorize every aspect of the article. You want to try and get what's the main point from this article and how does it relate to something that I said in class? Because the exams, which I imagine many of you think are important, the exams will be focused on stuff that was said in lecture. If I said something in lecture, there also happens to be a reading on it. We don't need to memorize everything about the details of the reading, But you should probably remember what did I say about the main point of that reading was there are two exams, they each 20% of your grade, they're both 50 multiple choice questions. We can talk about those more later. That's fairly standard. The final paper fairly standard, except as it relates to this other piece, which is probably different from a lot of your classes where you, um, are going to be monitoring yourself and logging it through, essentially a lab notebook about how you're feeling. This is just a Google form that you're going to fill out to get full credit. You should fill it out at least five days a week. We'll talk more about this. Your TAs will explain it more in class. It's listed in the syllabus. You can go ahead and fill it out if you want to get started. But if you don't start filling it out till tomorrow or Wednesday, don't worry. You'll have lots of time to make up at the same time each week. We're going to be giving you a different intervention to try this week. I shouldn't say hey, yes, this week, for example, it is physical exercise. Tas will explain more in discussion on three days this week. Try and exercise for at least 30 minutes. Maybe you're already doing that, maybe that will be a big change for you. I don't know. But you're going to answer a few of these questions on the Google form. That's the data that you're collecting yourself. You know, how are my positive emotions optimistic? Am I, how connected do I feel to people? Well, how productive was I? You're just going to be answering these questions whether you did the intervention or not. But at the end of the week, for next section, a week from Tuesday, you're going to do a little write up, analyzing that data like oh, well, on the days after I exercise, we're going to pick one of the variables. Oh, my cheerfulness, my positive mood was 4.3 And the days I didn't exercise, it was 3.8 Oh, I guess that means that exercise increased my mood by 0.5 or whatever. We'll explain that in a lot more detail, but these are the ways that you can come to understand yourself. Because we know that exercise works for people like specifically how much and what kind at this specific point in your life for your unique neurobiology. Well, that's this experiment that nobody else has done, but you can use the scientific process to get a better answer for yourself. The daily logging as five days. Something you're going to do ideally each morning, or at least five days a week. Interventions, you'll do three days. When you fill out the form, it'll ask you like, did you do the intervention in the last 24 hours? And if you did it yesterday, they say yes. If you didn't, you say no. And then I'll help you analyze the data clocks fast. I also wanted to share a few thoughts about how to manage your expectations about this class. Because I noticed the first few times I taught it, I'll get these comments on, you know, the evaluation form at the end where it made me completely question like, am I doing a terrible job? I reframed that and I was like, oh, I just need to do a better job of managing students expectations. I don't need to actually change the class. Like my expectations and their expectations are different, students had different expectations that weren't aligned. So I just wanted to take a few minutes to help you understand what exactly you're getting into. I just reimagined some of these comments as tweets. Don't worry, people did not say that. They did not tweet this out or post it. The comments made in some of the teaching evaluations this person. So there's sometimes some rambling on the same points and say, you got me okay. Sometimes that's the way I talk. I cannot fundamentally change who I am. I can take the note, say, oh, I should try and make it more apparent like what parts of the information are most crucial to understand. But sometimes it is important to help different students get the material by explaining a similar thing in different ways. Or to provide context and not just try and remember a list of do I sometimes perhaps go on a tangent. Some of that though, is to make it more enjoyable. Some of that is to help with learning. Some of that might be just inadvertent and I will do my best to wear when it is not helpful. But I appreciate that feedback. This student said, I don't like multiple choice tests. Fair enough. Okay, that's just an observation. Great. We happen to have multiple choice tests in this class. You might, it's unfair. I know so much information, This class is helping me so much, and it's just not captured on a multiple choice tests. And I get that's a frustration, yet here we are. There is multiple choice tests. If you want help figure out how to do the best on those or to how well in other parts of the class so that grade in the test doesn't affect you as negatively. We can talk about that. This student said, there's a lot more biology than expected. Maybe put in the course description for those who are not life science inclined. But it wasn't too bad. I believe I did put it in the course description. However, I can't force you to read the syllabus or to read what I wrote, but real, make it more explicit in class. Essentially, one of the things I found interesting about this comment was the contrast with this other comment. I found it to be more of a self help class than anything. If I wanted self help, I'll read his book. You're welcome to read the book on your own. You don't need to take this class. You can recommend it to other people. But this is where I was stuck. I was like, oh wait, Should I make it more just like feel good and helping people? Oh, do I need to make it more scientific? And that's where I read, like, oh, both of these students have incorrect expectations about what this class is? I'll say that everything really that you need to know to properly manage your expectations about this course is contained within this sentence. Applied positive neuroscience is an introductory life sciences course. Yeah, you have to learn neuroscience because it's there in the title. You have to memorize something. It's not going to be just about memorizing everything. We're not trying to trick you, but yes, you are going to learn neuroscience also. This is an introductory life sciences course. If you're a neuroma, you're like, you didn't explain the D two dopamine receptor in the shell of the nucleus. Like okay, well you're in the wrong class. You might also get a lot out of it because we're learning how to apply this information. Both of those things are then, yes, you have to understand science. It might not get as deep as some people want it to be. That is what it is. Now you are informed and you can make your choices. Whether it is the right class for you or not. I guess already went over the self monitoring, but you can find that link in the syllabus. He'll ask you like six questions. We'll talk more about what the write up looks like. The write up won't be due until a week from Tuesday. The breakdown is only 40% of your grade is exams. If you're worried about the multiple choice or whatever, come talk to me. I can help you give you strategies. But also 60% of your grade has nothing to do with multiple choice exams. The mid term is week five, Monday, week five, and the final exam is Wednesday of week ten. The final paper will be due during finals week. Okay. So with that all being said, your expectations are managed. You understand what you're getting into? We can get into the time where you can start taking notes, about 20 minutes left. That clock is fast, I can be correct, yes, it is 12:00 This class goes to 12 20. What's happening in the brain? Well, you've probably heard this idea that you only 10% of your brain. And if you could use 11% of your brain, you'd be a genius. And Einstein used 12% of his brain. And if you could use 14% then you'd be like that guy. In limitless idea that you only 10% of your brain is 100% all of your brain all of the time. That myth 90% wrong, because you're using 100% of your brain. Math joke. It's not a good math joke, but it is technically a math joke. You're using your whole brain, everything is doing something. But that doesn't mean you're using it as effectively as you could. For an athlete to run faster, you have to more muscle, you got to become stronger. But if your bicep the same time as your trip or your quads flex the same times your hands, you could be using lots of muscle, clearly not getting anywhere because those muscles are opposing each other. The same is true in the brain. You have all of these circuits. But sometimes like, well, your habits are pulling you in one direction and goals are pulling you in a different direction. And if you don't understand those dynamics, then yeah, you're using your whole brain, but you're not being as effective as you could and it might get in the way of achieving your peak performance. Now one of the reasons I describe this class as being focused on well being as opposed to happiness is because there's a lot more research on well being, but also the term happiness has a lot of unhelpful connotation. We often think, oh, happiness is just like being happy. Simple, right? Just be happy. A positive emotions, that is an important part of our well being. But it's not the entire thing. I, the common notion that we have of happiness, I like to call that Spring Break happiness, where yeah, you just get to do whatever you want. Whenever you feel like you just feel amazing all the time. And if you want to get drunk, you'll get drunk. If you want to go, you go surfing and that happiness is fantastic for about a week or two, then at some point you'd be like a, but I just want to hang out at home or like, oh, I want to do something with my life or like I want to accomplish these meaningful goals or have more meaningful connections. It gets old just doing nothing but hanging out all the time. If that's not you, that's fine. But what these researchers notice is like, yes, we need positive emotions. They're a super crucial part of our well being, but they're not the whole thing. We also need engagement. Just have our attention, be fully immersed in something, whether or not we're happy at the time. If you're playing video games, you're not thinking, I'm so happy, like you're fully absorbed in it. Or if you're playing basketball and you're in the zone, like you're just fully immersed in it. And that's a crucial part of our well being as well. Perma by the way, if you haven't got to this point is acronym stands for positive emotions, engagement relationships. We need deep connections with other people in order to feel belonging and to feel accepted. We also sometimes need casual interactions to have more fun. Because these things relate to each other. Some relationships give us more positive emotions or engagement. Other relationships give us more meaningfulness. And these things can interact. We need to feel like what we're doing matters. Like our life has a purpose. Then we also just need to get stuff done sometimes even if you haven't figured out your meaning of your life or you don't get to see your friends as much as you want. Like sometimes you just like get a lot of stuff done and you have a sense of accomplishment that makes you feel good. It's just that sometimes we use the wrong strategies. Like what we really want at the moment is a sense of meaningfulness, but we don't know what it is. It's easier to settle for, well, if I just get a lot of stuff done and that makes me forget about that, I don't know what's actually meaningful. But it's helpful to realize that your brain, all of these different things, if you only need one thing, it would be much easier, at least in the short term. Your brain is complex and wants a lot of different things. This idea of the perma model was first shared by this guy, Martin Seligman, who was the founder of this idea of positive psychology. I really like the idea of positive psychology. You probably see it on Instagram or Tiktok all the time. There's a lot of actual research on it. And I agree with most of it's fascinating, but I'm like, okay, how does that connect to what's actually happening in your brain? This is a psychological way of looking at it, which we'll also talk about in the class sometimes. But we're going to connect these ideas to your brain if you're stuck in depression or anxiety or you just doing something when you intended to do something else. Either it's an addiction or you just have bad habits or whatever, it's very easy to get second the idea of wondering like what's wrong with my brain. Obviously I'm missing some piece that helps connect with other people. That just helps me focus or stay on task and what is it? And I'm here to show it to you. I use depression here as an example because it's more extreme. So it's a little more obvious, it's still subtle. But the depressed brain is on the left and the healthy control brain is on the right. And if you just look really closely at the right dorsolateral, there's no brain scan or lab test or EEG or MRI that can diagnose you with depression. That might seem counter to what I was studying in graduate school. I was surprised by that as well. And it's like, okay, it's got to be someone you can measure about the brain. I would say, oh, you're depressed? You're not depressed? And it turns out like, no, not really, not on an individual level, yes. You can take 50 people with depression and 50 people without depression and scan their brains under some tightly controlled laboratory conditions and see, oh, on average there's statistical differences. And this, but that is not the same thing as saying this part of your brain is broken because it's much more subtle and nuanced than that feeling unmotivated or disconnected or stratus or whatever it is. It doesn't mean that there's anything wrong with you to understand why it's important to understand how the brain works in the first place. You see your brain is full of these intricate and interacting neural circuits. I know not just because I have a Phd, but because it says so right there now you have a circuit for planning, and worrying, and enjoyment, and mood, and memory. You don't have to write all those down, but because you have circuits for habits, and addiction and pain, and like just about everything else, it's just that this is a crucial part. The tuning of each circuit varies from person to person. Like how reactive it is or how much it controls another circuit. Just like some people's muscles are more reactive or stronger than others, in the case of the brain, some people worry, some people worry, Some people are more decisive, some people are less decisive. But crucially, there is nothing inherently wrong, or better or worse about having particular circuit. Having any particular tuning of the circuit, that's not. Where the problem is. You might be someone who worries a lot, but that is not the cause of all of your problems. Some of it can be changed, but some of it is like, well, you just have a worrying circuit that activates a lot. Is that bad worrying is just thinking deeply about potential problems so that you could potentially avoid them. Right? There's inherently wrong with inherently better to say about being more decisive. Because you can decisively make the wrong decision and just charge ahead and do something stupid. Now, if you are someone who worries a lot but you're very decisive, well, you probably don't get stuck because you worry, but then you make a decision, you move forward. If you're someone you don't worry a lot but you're really indecisive, well then you also probably don't have a problem because, yeah, you don't get a lot done, but you're not worried about it. You wouldn't necessarily be that successful in the traditional sense or accomplish a lot, but it wouldn't bother you as much. But the problem arises when you have a high activity in your worrying circuit and you have a high activity in your indecisiveness, and your worry exacerbates your indecisiveness. And your indecisiveness prevents you from moving past your worry. And that's what creates a problem. Even if those connections exist in your brain, that is not a problem. Unless your current job or your current circumstances require you to make a lot of decisions, you can't really say like, oh, that's the problem with your brain. It's just the way my brain is functioning right now isn't best adapted to the environment them. In some of my parts of my brain I cannot change. They are just fundamentally either how the human brain works or fundamentally how my brain works. But we can change the tuning. I use the tuning specifically because of this example that I like to use to make it a little more concrete. Because this idea of it's a bit abstract to think about all these different circuits that are connected and one feeds back on the other and there's all this activity and that's abstract. I'm going to give you a simple example of a feedback circuit, which is a microphone and a speaker. A feedback circuit, by the way, is just one in which the output either goes somewhere else and then that becomes back to the input or just feeds back on itself, and the output becomes the input in a microphone and speak. What is supposed to happen is that you talk into the microphone and the sound comes out of the speaker. When you stop talking, the sound stop, zoom is just like restarting. I don't know what's going on anyway. But it's helpful to realize like, okay, if you've probably had this experience, if the volume on the speaker is just a little too loud or the microphone is oriented in just a particular way, or it's a particularly sensitive microphone, then when you sing into it or shout into it, then that sound coming out of the speaker feeds back into the microphone and then gets amplified again. And it leads to this screeching, um, output. And we can objectively say like, yeah, that's what it's supposed to do. I don't like that, I don't like how it's functioning. And yet, nothing is wrong with the microphone. Nothing is wrong with the speaker. Both of them are functioning. It's crucial to know. All of that is like the preamble to, I'm having this internal comedic battle up here because I'm trying to just record the lecture and then the recording software keeps starting and saying it's recording. Now, now you're Ted having to do an even more complicated job than you can possibly believe. Mostly for myself. Remind myself of why I'm getting distracted. That's a big overview picture of how it fits together. In the last couple of minutes, I'll just start by introducing some of the specifics of how it works. From the small level up to the larger level your brain has these cells, the primary processing cells in the brain are called neurons. These neurons are organized into tissues and circuits. And at the bigger level then we see them at the whole brain. Some of this stuff has helped to understand like, oh, how's it working on a cellular level? We'll get into the details of this next time, but I just want to point out that you have 80 to 100 billion neurons in your brain. But interestingly, most of your brain is not neurons. It's made of other cells. Neurons are only about 10% of the brain. We've got a couple of minutes left just so you can manage your expectations. Most of the cells in your brain are doing other stuff. They support the neurons. Actually, I think that's where that myth of we only use 10% of our brain originated. Because we realize that, oh, neurons are doing all this complicated processing, oh, only 10% of your brain is neurons. Well, it's a misunderstanding of how that works. Like you need all these other cells in order for the neurons to function optimally. The way the neurons work is they have these fingers that are listening, called dendrites. They listen to the either surroundings or to other neurons. That creates electrical signals. Which the neuron decides is it going to send out an electrical impulse? And if it does, then it sends this electrical impulse down this long wire called the axon, which is reaching out to all these other neurons around it. And it releases a little chemical ends called a neurotransmitter. The bringing is this complex electro chemical organ will go into more of the specifics about that or reiterate some of those details next time. But just to wrap up, I want to point out that or to get into the self help aspects of this course. Like there's so many different solutions that you can use whenever you're feeling stuck from physical activity to changing your sleep or mindfulness, or gratitude, or even just understanding why you're stuck in the first place. These things are all interconnected. I came across this tweet on Twitter a few years ago, and then I was like, hey, that's from my book. So I decided to attribute it to myself. Basically just points out like, yeah, sometimes it feels like you have all these different things. You have to juggle my exercise and my sleep and whatever. These things are all interconnected, you don't have to solve everything at once. You just need to make one little change that's different and it'll make the next change easier and the next, So the path is always open before you. Thank you. Yeah, 1 second.

**Week 1 lecture 2**

T. Okay. So we're going to go ahead and get started. Welcome back to Psychiatry 79, Applied Positive Neuroscience. To continue setting your expectations for the class yesterday was probably the easiest. Had the least amount of information, the amount of just sitting there and thinking, oh, this is cool. By contrast, today is going to have the amount of specific information and learning. Neuroscience might be a rude awakening for some of you who are like, oh, this is like a Ted talk, I can just listen to. We do actually have to teach you information, but the good news is that every other lecture from here on is somewhere in between those two. So that will set the range for some of you if you have a lot of experience in science or neuroscience like some of this might be review for some of you might be completely new information will be totally overwhelming. But the good news is that I'm going to introduce a lot of brain regions and chemicals and concepts. And then through the rest of the quarter we'll be revisiting those in more detail. If you don't catch it all the first time, it doesn't make perfect sense the first time. It's okay, because this is a process and the goal is not to force you to like memorize all of these things. It's to understand how they all fit together, how your brain actually works. Yes, that does sometimes require remembering some things, but you don't need to memorize it immediately. Right now. Focus first on understanding them. And it's much easier, much, much easier to memorize. Remember something when you understand it, how it fits together, how to contextualize it, how to connect it to everything else that you know. That's one of the reasons why I offer background of different stories because I understand how memory works in the brain. It's related to the hippocampus, we'll talk about that today. But you remember things in relationship to other things that you already know. So if you focus just in trying to remember it, maybe you'll get lucky. Maybe you're good at memorizing. I don't know. If you focus on understanding it, then it will be much easier to remember. So we finished yesterday with some of the specifics about how the brain works and so I'm just going to review those. If the didn't stick the first time. Well, I should say we have these brain cells are organized into these networks and tissues. And those tissues all fit together to make the whole brain. The brain is something that you can see on a macroscopic level. Like you could cut someone's head open and look at their brain, or you could do an MRI as this is, and look at their brain or the magnetic resonance of their brain that is all composed of these little tiny microscopic cells. Most of the cells in your brain are not neurons, but the neurons are the ones that do the complex processing. It's kind of like in your computer. The CPU is the part of your computer that is like the chip that has like all the complex processing and does all these, you know, gigaflops or whatever. But that's just like a small part of your computer, like most of your computer is just like other stuff that like displays stuff or like has the microphone or just stores memory or whatever. So that's kind of what it is in the brain. About 90% of the cells in your brain are helping support the neurons. And the neurons are doing the interesting processing. Some people would dispute that, but that's the simplest way of understanding the brain. You have about 80 to 100 billion neurons in the average human brain. You have the when you're born and then your brain slowly decays as you get older, sometimes quickly. But the good news is, it's not simply the number of neurons that's important. It's how they are connected. The neurons have the same structure. Where the dendrites are sort of feelers or listeners to what is going on in the environment around the neuron. They are to external stimuli, this is the great over implication by the way. But sometimes they're listening to external stimuli. Sometimes they're listening to inputs from other neurons. And it takes all of those inputs in the cell of the neuron, that the nucleus, that's where the DNA is held. But the other thing that happens in the cell body is the neuron decides, okay, based on everything I'm hearing, is this something I should send an electrical impulse about or not? How many electrical impulses? And it sends those electrical impulses down this long wire called an axon. And that axon can go really short distances, like a fraction of a millimeter to the neurons all around it. It can travel from one side of your brain all the way over to the other, several centimeters. In your body, you have axons that go from your foot all the way up through your spinal cord, like a giraffe. There are some neurons that go all the way up that long neck. Does one cell stretch out that long? It's this electrical impulse traveling down that long axon. These other cells, some of the supporting cells, help make those connections, make that communication move faster. That electrical communication move faster by insulating and wrapping those axons in a substance called Myelin. We'll talk about more what that looks like on a macroscopic level. But one of the interesting things about Myelin is that the more Myelin you have wrapped along these axonal wires, the faster those electrical impulses travel. One other interesting aspect of this is that there's something called experience dependent myelination. Which means that the more you use certain axons or certain pathways in the brain, more mylan gets wrapped around and the faster they start conducting things. This is one of the ways that your brain can change. There are many others, but the more they use certain axons, then the faster they start conducting information in the future, what happens to that electrical activity that flows down to the end of the axon? Well, when it reaches the end of the axon, that electrical activity causes the neuron to release a little chemical called the neurotransmitter. It squirts out this little neurotransmitter which floats to the other nearby neurons that are listening with their dendrites and they decide what to do with. It activates them, it deactivates them, it does something else, and the whole process continues. The electricity is flowing within the neuron, and when it gets to the end, it creates a connection with another neuron or many other neurons. That's called a synapse, where it releases this little chemical called neurotransmitter. And it stimulates or inhibits the postsynaptic neuron. The neuron on the other side, it's this whole electrochemical process. So a synapse is just the place where the axon of one neuron gets, gets close to another neuron so that it can transmit these chemical signals called neurotransmitters. To give you a scale of how this alps together, the average neuron has about 7,000 synapses. It's 7,000 other neurons because it could be have many synapses on the other neuron, but it's connecting with a lot of other neurons. And this is just an average. Neurons in your brain might just have a few hundred synapses or even maybe less than that are known to have like 50,000 or 100,000 synapses at a lot of connections. So that's the 80 to 100 billion neurons in your brain have 7,000 synapses on each, on average. That results in a lot of connections. And those connections are often where the important stuff happens. Yeah, this slide, by the way, just illustrates some of the complexity. This image from a researcher like 100 years ago who found, oh, I can use a certain chemical to stain neurons and look at them under a microscope. And it stain certain neurons. If you can see how this together, there's the cell body of the neurons dendrites coming out and the axons are going to connect. Each of these is just one neuron. And some of these axons just go really short to the next door neighbor neuron. Some of them are going really long. At least on a cellular level, could be a few centimeters even, or over to the other side of your brain. When it comes to these networks though, one interesting thing that researchers notice is that the cell bodies of neurons tend to clump near each other. All neurons have a cell body where those cell bodies are located in the brain tend to be really close to each other. The also tend to clump together in the rest of your body. When a whole bunch of axons are in the same place. We call that a well, you have some cell bodies, say in your spinal cord and just adjacent to your spinal cord. And then you have a nerve that runs to your arm, down your fingertips that is the axon of those are the axons have a whole bunch of neurons when they're bundled together. We call that a nerve in the brain. Since there's so many axons, there's not really distinct nerves, we don't call them. Sometimes we could identify certain tracts. But the most obvious thing, when you're looking at a brain either on an MRI or an actual brain that's been preserved or sometimes even, you know, freshly dissected brain. The most obvious thing is there's a slight color difference between where all the cell bodies are located and where all the axons are located. So you may have heard of the term gray matter. Gray matter refers to the fact that under certain stains, the cell bodies of the neurons look darker gray, while the axons look white. We call that white matter, all shades of gray. But this is an MRI slice down the middle of the brain. And you can see here around the edges, there's like this dark gray stuff. There's also some dark gray stuff in here or dark gray stuff around there. Those are the neurons, those are the cell bodies of the neurons. They're all clumped in these narrow bands in the small parts of the brain. And all of this white stuff are all the axons connecting all of those neurons. So the cell bodies are called gray matter. The axons are called white matter. The reason why it is white or why it looks white is because of the myelin. Myelin is a fatty tissue and if you ever eat animal products or you eat meat, you may notice that the fat on the meat is white. And that's why the Myelin is white because it's basically just fat wrapping around all these axons. This is also one of the reasons why getting enough healthy fats in your diet is super important for proper brain function. Because fats are so important to developing all of these connections and supporting the myelination process. Oh yeah, that's actually my brain. I forgot that I've been scanned like I don't know how many times, like 200 times like an MRI. Like it's a very interesting process if you have an opportunity to volunteer for a study. Like it's kind of cool to be able to. Go inside this machine and then actually see a picture of your brain to help. That's the big picture, okay? There's white matter and there's gray matter. But different parts of your brain do different things. It has specific functional organization. It every part is just interchangeable. There's some basic guidelines for how the brains organize that they want to share. The first thing that you may notice is that it's really wrinkly. What you're seeing here is just the outside surface of the brain. In the brain, we use the Latin word surface, which is co is just another word, first surface. Because the brain evolved in stages, There are some parts of the brain that used to be the surface and then new parts grew outside of this. This is technically called no, or the surface, The brain and almost everything you see here is not, the only part isn't neo cortex that you see is this part here. This nubbin here is your brain stem. We're not really going to be talking, I suppose we talk about some brainstem processes, but the brainstem is the deepest parts of your brain, just for your curiosity, is the cerebellum. There's some cool aspects of the cerebellum. There are a lot of people who do great research on the cerebellum. Oh, this is the only I just read about it. Pretty sure someone could test. I believe they are testing the emergency Broadcast system of the United States. We could double check to be great if I had to align this with the stress response discussion like just kidding, Can we confirm that it's a test? Does anyone to say, okay, I'm glad I saw that in the news this morning. I think this is going to happen over the next ten to 15 minutes. We'll power through. Yeah. And don't worry, it wasn't even if you had your phone on silent. Like, I think it overrides that, so don't worry if it happens to you. So yeah, the cerebellum does some cool stuff. It's really important in getting better at movement, but we're not really going to be focusing on that, so you don't really need to understand what that does. But these various parts of the neo cortex can be divided into lobes and there are four main lobes. We're not going to be focusing actually on all of them, but I figure I should let you know what they are. The opal lobe is all the way in the back. These are named for the bones. The parts of the skull that they underneath the occipital lobe is in the back. That's where a lot of visual processing happens. It's weird because your eyes are in front. I don't know if you notice that, but all the information from your eyes go directly to the back of your brain and that processes visual information on the side here. This is called the temporal be, you might know if you know Latin, it's related to time. The reason it's called the temporal lobe is because on your temples right here is where gray hairs usually show up. And someone thought it was clever, like, oh, that shows the time. They call that the temporal bone. But that's the temporal lobe on the side, that's why it's called the temples. The temporal lobe deals with auditory inputs from your ears. The deeper parts of the temporal lobe also deal with a lot of really interesting emotional stuff that we'll be talking about. You can just remember that where it's located on the sides, but deeper. The parietal lobe deals with a few different things. It deals with spatial information and awareness. It also deals with your sense of touch, regions of the brain that are in the back. There's a professor here, Robert Builder. There's only two things you need to focus on. There's the front, let in the front, and then there's the back lobes which is part. Which is helpful for organizing them. The reason why we can lump all of these three lobes in the back together is that those are primarily all focused on inputs. They are sensory processing units. They're focused on information coming from the outside world, in what we hear, what we see, our senses, and so on. The frontal lobe is the output part of the brain. It's the front part here, and, uh, this also has some other complex processing power, but that's the part that controls your muscles and what you do. So that's the output part of the brain. By the way, when it comes to brain evolution, the oldest stuff is deep down on the inside. It evolved kind of like a city where in a city the oldest parts are usually the downtown. Downtown LA is 160 years old or whatever. And as you go further out, well, those are the parts that were more newly developed. And that's why the neo cortex, a fun little experiment. The neo cortex, the newest, partly evolved. I mean, they're still 40 million years old or whatever, but those are on the surface and the deeper parts are the oldest that are, you can't see just from looking at the surface. One thing that can help you understand about how special the human brain is, is to compare it to brain evolution over time in various animals. This image isn't to scale, but it shows these different organism brains on the same scale. What it's illustrating in these various colors is green is the sensory motor cortex. It's lumping together the parts that you feel to and also of moving your muscles is the green blue part. These specifics you don't know, but this is for the illustration purposes. The blue parts are the auditory, the red parts of the visual cortex. Does anyone notice anything different about these brains that you would like to anyone want to raise? Yes, the majority of the brain is a small portion of the human brain. Yeah. She said the majority of the rap brain is only a small portion of the human brain. One thing is like, oh, the sensory regions that you described are these primary cortical regions is what they're called are in the different colors, that's at least half of the brain. Those colors are really small part of the human brain. These are called primary cortical regions because they are generally devoted to one specific thing related to your body. The auditory cortex deals with hearing, the visual cortex deals with seeing throughout evolution, and less of the brain actually is devoted to those primary sensory or motor regions. Yeah, there's another. Yeah, yeah. So the question is, do the wrinkles have to do with more surface area? And that is exactly what the wrinkles are for. One of the other obvious things about this is that this rat brain is mostly smooth except for the cerebellum back here. And the cat brain has a few more wrinkles and the human brain has a lot more wrinkles. Are those wrinkles there? Well, if you think back to a few slides ago when I talked about the gray matter I showed you was in this narrow band around the edges. Well, if you are trying to fit more gray matter into the brain and it's only at the edges, you really only have two options. You can either make the head a lot bigger and keep it smooth. That creates problems for, you know, a bipedal organism trying to walk around with a gigantic head. You know why? You don't see a lot of Tyrannosaurus Rex anymore. That's a joke, but the other reason is for giving birth. Like it's very difficult to give birth to something with a gigantic head. And so nature realized like ah, we don't even make the head bigger, we can just wrinkle it up and shove it into a smaller space. In the same way that if you had a newspaper and you're holding it like this, well, you can barely, you know, fit through a door. If you crumple it up, you can get the exact same amount of surface area in a much smaller volume. And so that's why our brain evolved that way. To be able to fit more neuron cell bodies and more processing power into a smaller space. We can see that the primary cortices, the primary sensory motor cortices shrink relative to the rest of the brain, because most of the rest of your brain is devoted to these higher order functions. It's not input, output, stimulus response. Yes, you get an input from your hearing, but then you process that in a lot of different ways. And that's why if someone just says a word, I'm trying to think of if someone like what's a good example? This alarm that just went off. Right. Like if there was some other scenario where we didn't already know that there was an alert, then oop, you might be a lot more panicked and instead of sitting here calmly watching me do election might you might leave, right? But also if you've got an alert and everybody else just sort of calmly, man, and put it down their phone, then you might we, should we be doing something about this? But you would just sit there because you're taking all of those inputs, those visual auditory inputs. And you're combining that with your previous experiences. You're combining that with your expectations. You're combining that and all of that gets processed and all these other association quart. And then your frontal lobe decides, well, what should I do about that? And then either you either move your muscles and go somewhere, or you sit there and you pay attention. So most of your brain is devoted to these higher order processing functions. And this just sort of illustrates on a size scale, what we're talking about, the rat brain. You can't tell it from here because they're all on the same scale. But that's the other thing that's pretty obvious when you look at it to scale is that, ah, the human brain is a lot bigger than the rat brain. This is one of the reasons why we have a lot more complex behaviors and perhaps more complex thinking because we have so much more processing power. Before you get too full of yourself, I would like to point out the dolphin brain right there. Like if you were just looking that on a scale like Hmm, which do we think is the dominant species of this planet? I don't know if you've read, has anyone read Hitchhiker's Guide to the Galaxy? Ever seen the movie? Yeah. They talk about, you know, dolphins are really the ones in charge. And if you just look at the brain No. That you could see why they have a pretty good case. It looks bigger, looks more wrinkled. So we humans like to think that we're so smart and that's why we've succeeded. But probably our opposable thumbs had a big part in it. But, you know, our brains are definitely doing a lot. But that's not our only advantage. That's the overview of how these different brain regions, different parts of the brain, fit together. Those four lobes can be subdivided into dozens, if not hundreds of other ways. Because there are subtle differences in the functionality between primary visual cortex and the secondary visual cortex and the tertiary visual cortex and other association cortices. And we're not going to like, it's fascinating. I encourage you to learn more about the brain. When I was majoring in your else, I was like, oh, that's so cool. Like how the visual system works and how the auditory system works and processes, and how we combine the visual system with the auditory system. Like there's a lot of fascinating stuff about the brain. But when it comes to your own well being or your own productivity or things that you can observe or influence about your own brain, the other stuff is like interesting. But so what? So this is not to say that there aren't medical problems with other parts of the brain or that these aren't super crucial. Uh, to your well being. But it's just like, well, these aren't necesarily parts that you can influence. So feel free to learn more about other parts of the brain. We're going to be focusing on a much smaller subset, so I want to go over those regions now. These are the prefrontal cortex, which is the front part of the frontal lobe. You saw the frontal lobe, where am I? The frontal lobe is basically the front half of the brain. And most of that, from about here to here, is called the pre frontal, which is just the front part of the frontal lobe, the back parts of the frontal lobe, Those are the parts that are dumb. Those are the primary motor cortices, like, oh, if you stimulated that part of the frontal lobe, like oh, your arm would twitch. But the prefrontal cortex, the front, that's what is the most newly evolved part of the brain. I'll illustrate it on this rat brain. You can see the rat brain is flat and then it puffs up here in the cat. And it keeps getting bigger and bigger here in the human. Because the frontal lobe is the part of the brain that is most highly evolved in humans and primates. Relatively more of it than any other animal. So it's essentially the front third surface of your brain. I've conveniently gone bald over my prefrontal cortex. To illustrate that point, as you can see, I have a very large prefrontal cortex and it is growing. But yeah, this is, we'll talk about some of the more specifics. But, you know, some of you just to cut off any questions like no, you cannot tell how smart someone is by the shape of their forehead. This is a concept called phrenology. This is sort of on an evolutionary scale. We got bigger, any individuals shape or size of their prefrontal cortex. It's can't really tell anything because it's not the sheer size that matters. It is all of the connections. For example, men on average tend to have larger brains than women. That is just an observation that scientists can make. That what that means though, uh, well, that's something different because why is that? Well, brain size tends to correlate with body size. And men tend to be larger than women. And that's all that means, because brain size is not correlated to intelligence. I mean, there are extreme examples, like you can have brain damage or part of, you know, brain that isn't fully formed but on average, in common usage, no, you can't tell anything about someone's intelligence by how big their brain is within the normal variation. So that's just a fun thing. You can, ah, men have bigger brains than women, then people come to their own conclusions, but that doesn't correlate with anything. The prefrontal cortex is the analytical part of your brain that is involved in thinking and planning, and impulse control. Its job is to regulate these deeper regions, the emotional circuitry and the habit circuitry. The emotion circuitry is called the Limbic System. This is a deeper set of structures that used to be the surface of the brain, but then these newer parts of the cortex evolved outside of it. This is responsible for processing your emotions and your memory. We'll go into some of the details, but regions you may have heard of like the amygdala, and the hippocampus, and the hypothalamus, these are all parts of the Limbic System. They are located not on the surface of the temporal lobe, but like deep into. The temporal lobe. The stratum is an even deeper set of structures involved in habits and impulses, and, and reward learning. And we'll go into some of those details and I'm going to share some of these details in this lecture. But it's not like we're going to learn a whole new set of brain regions. Every lecture we're going to be coming back to these ones and seeing, oh, how does exercise influence these regions? Or how does gratitude influence these regions? Or how does social connection influence these regions? One way to organize it is just in terms of how old they are. The oldest is the stratum, and the limbic system is a little bit newer. And the prefrontal cortex, the fancy revamped part. That's why these are sometimes described as the reptilian brain. It's being like the stratum, the brain stem, and the mammalian brain being the Limbic, because those evolved more recently. And then the primate brain, the prefrontal cortex, kind of as like a baseline guidance, like oh, okay, just understanding how complex the processing is going on and how evolutionary ancient these are, but it's not technically accurate. If it helps you remember them, like go for it. But it's just, it's not technically accurate because like even dinosaurs had like an early version of the Olympic system. So as long as we're talking metaphorically, I think it's helpful to just like, okay, have some metaphors that things that you already understand. And so you can connect, oh, these brain regions to things you already understand. It makes it easier to remember them. So you can think of the stratum, which is this most ancient part of the brain that we're going to be talking about as like a dog. What does a dog do? Well, you know, you can't teach an old dog new tricks, right? Why? Like Because the stratum, one of its jobs, is trying to get you to do whatever you've been trained to do and whatever you've been practicing your whole life. And it's like, hey, like that's what we should do. And so if a dog has been doing one thing its whole life, it's hard to teach it new tricks, unless train it with rewards and repetition, which is also something that the stratum does. If you reward yourself over time, well, then you can start to change your behavior. You can teach an old dog new tricks. It's just easier to do it when it's younger and the brain is more plastic and able to be reshaped. That's true of the stratum as well. It's easier to learn habits when you're younger. Dogs are impulsive. If you just leave food there, they'll just probably eat it. They've been really well trained not to. And both of those functions are what's happening in the stratum. They're in different parts of the stratum, but yeah, it's impulsive. You might as well just eat food. Oh, unless you have some sort of training, oh, I'm not going to eat that food, or some sort of habit of not eating that food. Or as we'll see, if the prefrontal cortex plays a role. The limbic system is kind of like a small child. If it's too hungry, it like whines and complains and is upset. If it gets hurt, it whines and complains and gets upset if it hasn't slept enough, it's cranky and whines and complains and gets upset, like all of these different needs that the child has to feel safe, to feel rested, to feel, you know, fed and not thirsty or whatever. Like all of those things feed into the Olympic System and create emotion. So whenever you don't get exactly what you want, exactly when you want it, you feel emotions. Or when things surprise you or scare you, you feel emotions. And that's like the small child that exists currently in your brain. It is still there. You are no longer a small child, but now you have a more highly developed prefrontal cortex sitting on top of that. Your prefrontal cortex is the slowest part of the brain regions to develop your stratum, your Olympic system, and there's reactivity mostly developed when you're born. And that's why babies have different temperaments. But your prefrontal cortex slowly develops over about the first 25 years of your life. And its job is slowly to better regulate the habits and impulses, and emotions of these deeper regions. So it's kind of like the adult in the room. Sometimes people hear me talk about that and they're like, oh great. So I just always need to listen to my prefrontal cortex and ignore my habits and impulses and emotions. But that's also a problem because, well, it's possible to be like too much of an adult where you suck all the fun and enjoyment out of your life and you're like, no, I'm just going to think analytically and be logical and sometimes we get stuck there. So the key is really finding the balance between these different regions. To have them communicate in the way that is most effective for the specific circumstances of your life, given how your brain actually works. Because some people's stratums are more impulsive, some people's limbic systems are more emotionally reactive. And what the whole point of this is, of this class, really of all of your education, is to try and train your prefrontal cortex to make the most out of your unique limbic system and stratum. The slow development of the prefrontal cortex is probably also why it's helpful to not kill too many cells with too much binge drinking or too many drugs like while it's still developing. It's also the reason why your car insurance rates go down when you turn 25. The car insurance companies, they don't know anything about neuroscience. They've just looked at actuarial tables like, huh, that's interesting. It seems like around 25 people get in fewer accidents. They make less impulsive decisions. They have less drunk driving. Whatever they make, they're better at thinking ahead. Oh, so we should charge them less for car insurance. One of the main reasons for that is because your prefrontal cortex is finally fully developed and does a better job. So your prefrontal cortices are still developing and you can nurture them in the ways that you think will be most advantageous for you or don't it'll happen anyway. Uh, like I guess one of the takeaways from this class is like all of these things a, there's so many things that are shaping your brain, whether you're aware of them or not, whether you're intentional about them or not. So you might as well become aware of all these different forces, some of which you don't have control over. But sometimes you realize, oh, I could actually do X, Y, or Z. And that would actually help me not just today or tomorrow, but for the rest of my life. Because I'm going to influence the development of my prefrontal cortex. This is just an illustration of how they kind of all fit together and how it looks on an MRI. The prefrontal cortex is that front third surface, just those little grooves of the cortex. The limbic system, you can't really see it all easily on one slice, but that's deep inside the brain and the straight is even deeper still as you can see. It's like on the other side of all of that white matter, all of those axons. It's deep down near the middle of the brain. We have about half an hour left today. Hopefully you're sticking along with that. I'm going to go through some more specifics about these brain regions, But I just want to remind you, like if it doesn't stick or make perfect sense, we're going to be going back and covering these things throughout the quarter. But just also, as a side note, sometimes students get hung up because they're trying to make perfect sense of all of these regions and trying to understand the perfect logic of everything. And the problem with that is there isn't one overriding perfect logic to this. So I'm trying to explain it in a simple way that kind of takes all of these complexities of the latest research and sort of simplify it down to a point where, okay, it's sort of like understandable, but it's more complex than that. So sometimes I'll talk about features or aspects of these different brain regions. You're like, well that doesn't make sense and sometimes you can try and get it to make sense. And if it makes sense, then it's easier to memorize. It doesn't really make sense because There's not one theme of whole brain organization and we don't fully understand the brain. So sometimes things just aren't really going to make total sense. And you just have to learn, well, that's just how it is, right? These are based on observations that we have about the brain. We can't explain why it is. We can come up with bigger theories. In science, it's always useful to have theories because they can explain all the observations that we see and make predictions about things that we don't understand yet. But no theory is complete and sometimes there's stuff that doesn't fully fit into the theory. That doesn't mean it's pointless to have these explanations, It just means no, you should have these theories. And these stories just recognize, oh, they are incomplete. For example, we had this story for a long time. I mean, humans of everything revolves around the Earth, The sun revolves around the Earth. And that kind of made sense. Like explained why the sun seems to go in a circle around the Earth. Someone came along, I was like, oh, but if you look more closely, it doesn't really make sense and the planets are doing these things was like oh, a better, in other words, a better theory or hypothesis about that explains all of that and makes better predictions is oh, well, the Earth and the planets all revolve around the sun. And that's a much better theory and explains a lot. It's still incomplete. However, it's not actually true. The Earth is not a revolve around the Sun. The Sun and the Earth revolve around some shared center of mass. That is a more nuanced and more correct theory that is irrelevant. 99.9 99% of the time I explaining these things in a simplified way because often that makes them more useful. But just don't trick yourself into thinking that the simplified explanation is reality. That's the purpose of explaining that. The stratum, we're going to start with the deepest and oldest parts First, the stratum has two basic parts to it. The upper part, it's called the dorsal stratum. It's like the dorsal fin on a shark. And by the way, we're not really going to be talking about left right differences. I know a lot of people make these theories about left brain versus right brain. Those are kind of over exaggerations and most of the pretty much, I guess all of the reasons were you're talking about a exists on both sides of your brain. And there are some subtle differences between the left and right lobes, but we're going to be talking about what these different parts of the brain actually do. Left brain, someone being left brain to right brain. Oh, that's a metaphor. Sometimes that helps you understand, oh, you're more creative or you're more analytical. And I think that metaphor can better be explained by these different regions of the brain that we're going to be talking about. The dorsal stratum is where your deepest, most ingrained habits live. It tries to get you to do whatever you've done previously. That's a very simple algorithm to stay alive. Because it evolved in the principle of like, well I'm alive now, I guess I should just keep doing whatever I have been doing. Because your brain evolved for really only two reasons to survive and reproduce. So anytime things don't make total sense in your current world, you realize that, oh, your brain didn't evolve in your current world to make you happy or fulfilled, involved, for you to survive and reproduce. You can use the tools that evolved to achieve those other things, but your brain is not always going to make it automatic for you. You can think of the strike, I'm sort of like tracks through the snow that when you're first born you don't have any specific tracks through that snow. But the more that you say go down a certain path, the deeper that groove gets in the snow and the more likely you are to get stuck on that path. What's happening in the brain is specific connections or specific pathways are being strengthened or accelerated that make you do that habit. The good news is, well, you can create new habits. If you keep getting stuck in some old habit, well, it might be difficult, but you can start to create new grooves. Then the lower part of the stratum, also called the ventral stratum, help you keep track of that. We're going to call it by its other name, which is the nucleus acumbens. Accumbens is because Recumbent. It's like reclining. Nestled in this little hammock over here. The nucleus sucumbentss The lower part of the stratum is to get you to do what's most immediately pleasurable. It's the impulsive part of the brain. It's also trying to learn how your actions lead to different rewards or punishments. It's really key in learning, So both of them are deeply connected to action In both of these regions, the neurotransmitter, dopamine plays a big role. We'll talk more about that a lot. But in the nucleus acumbens in the stratum, dopamine pulls you back into your oldest, most ingrained habits in dopamine in the nucleus acumbens though, pushes you to do whatever's most immediately rewarding or to learn something that was rewarded or was new. So that you can change your behavior potentially in the future. So dopamine gets released in the nucleus acumbens when something gets rewarded, like you press a button, oh, and I won $5 or whatever. Oh, I open a door and like, oh, there's free candy in here. And that dopamine is like, oh, hey, great, I should do that again. Or sometimes when it comes to punishment, it's like oh, hey, don't do that again. But it's really a part of the reward and learning circuitry in the brain. We also release dopamine in anticipation of reward of like, oh, maybe if I study then I'll get an and that anticipatory dopamine that like, oh, this action might get rewarded in the future because the nucleus comes as part of the action circuit in the brain that motivates us to keep taking action until we get that reward. So like the first time you ever saw a Snickers bar, you didn't really know anything. You just you just tasted it and you're like, oh, it's delicious. I mean, you probably had some anticipatory dopamine because everyone else was excited about it, or your parents hid it from you, and you're like, oh, that's something that's exciting there and that made you want to try it, and then you're like, oh, it's delicious. And now, oh, if you're in the candy aisle at the store, you might release some anticipatory dopamine. And it's like, oh, well, you should keep looking for the snickers. And then when you eat the snickers, you get a little another burst. And now if you just walk by the supermarket, you're like, oh, maybe there's some snickers in and that motivates you to go in. And so these impulses can sort of propel you forward. And sometimes it's actually really good because we can impulsively do things that are good for us, like hey, maybe I should go for a run. I'll feel really good. Oh great. Sometimes, however, they can get in our way. And this also works in concert with the other action circuits in the brain. So we sometimes wonder like, why is it that I do things that I don't want to do? And that's because different parts of your brain want different things. They evolved for different purposes. They have different motivations. The prefrontal cortex, that's the part that's like, ah, I have this big goal. I want to go to medical school and I want to be rich and famous. Whatever it is, like great, good for you. But that's the newly evolved part. It's planning, it's strategic. And the stratum on the other hand, is like, well, that's doing most of the work. It's unconscious. It's much faster at processing. And it sometimes takes actions and makes a decision before you're even consciously aware. And you're like, but I didn't want to drink three beers right before the M cat. And that's why it's helpful to recognize the different logic that these regions follow and how your actions are a result of that conversation. The dorsal straight like when something happens, when an alert goes off on your phone, or you enter a new situation or environment. The dorsal stratum, essentially these are all voting for what you should do. And the dorsal stratum says, hey, let's do this because this is what we always do. Oh, I'm in this relationship and it seems to be getting kind of stressful, so I guess I should leave because that's what I usually do. It's I avoid things that are difficult and then your prefrontal cortex is like, yeah, we could do that. That's interesting though. Like it seems like we do that every time, and here we are stuck unhappy and alone and unsatisfied. Like maybe we should try something different and move towards this big important goal instead of just like. Doing whatever we have been doing, whatever feels comfortable. Then the nucleus Cubans jumps into that conversation and it's like, oh look, there's a cookie because it's pulling you towards whatever is most immediately pleasurable or boarding somewhere in that conversation. Your actions get determined now that whole conversation is influenced by the Limbic System, by the emotional circuitry in your brain, that when you are emotional, either really excited or really angry or really worried, whatever it is you heightened emotions in activity in the limbic System that biases the conversation away from the logical analytical, strategic prefer cortex and towards the habitual dorsal stratum or the impulsive nucleus acumbens, which is why you might have a great plan. But then you get overwhelmed and stressed out and these deeper subconscious regions take over. It's like why I love that great quote from Mike Tyson, the boxer who's like, everyone has a plan until they get punched in the face. Which is a great way to think about like, right, you have all your plans. I'm gonna study and we go to this class and oh, I'm gonna volunteer, I'm gonna go to Wooden Center three times a week. Oh, awesome. Great to have that planned. Oh, and then the stress of the quarter in mid terms takes over. And therefore your dorsal stratum is like, oh cool plan bro. We're just gonna eat, you know, cookies and drink three Red Bulls a day and, you know, go on with our life. And so sometimes there's a disconnect between what those regions want and it's often driven by your emotions. When you are really emotional, whether you're naturally aware of it or not, you're going to either fall back into habits and routines which you may or may not be aware of or act impulsively. What is this emotional circuitry that I'm talking about? Well, that's the Limbic System. And we'll go into some of that nuances here again, we'll expand on it more and revisit some of these ideas later in the quarter. The Limbic System is this set of regions not quite as deep as the stratum but deeper than the neo cortex. It's a set of regions which are closely connected to the hypothalamus. Why is the hypothalamus important? Well, I'm going to bring you back to like ninth grade biology. Does anyone remember the term homeostasis? Yes. Okay. We got some people like homeostasis, There's just this idea that for life to exist, it has to stay in this narrow band of circumstances. You have to have a certain concentration of water at a certain temperature and a certain amount of oxygen, and a certain amount of sugars and energy. And if it gets too much or too little, then you die. So that's primarily what the hypothalamus is involved in. It is paying attention to like, is my body too hot? Is it too cold? Do I have too much water? Too little water? Do I not have enough blood sugar? Do not have enough oxygen? And if any of those things happen, that creates emotions. Because emotions help you do something about reacting in some way to the world so that you can survive. So your emotions are intimately connected with your survival. You can practice this by just like, say, don't breathe for 3 minutes. And just a, you probably have emotions about that. It's why like oh, if you don't eat all day or you get terrible sleep, you feel off or out of sorts. Because all of these things are important to your survival. And they trigger emotions very closely connected to the hypothalamus is the Amigdalas. The reason you may have heard of, it's sometimes called the fear center of the brain, but it's responsible for like a threat detector because the hypothalamus can tell you, hey, your blood sugar is low or your blood pressure is dropping because you're bleeding really bad, Oh, you're really pain. Like we should do something about that. The amygdala can try and predict. Well, you don't need to wait until you get stabbed or you don't need to wait until the lion bites to start running away. Like you could see a lion and then start running away before you're in danger. It's trying to anticipate. Ahead of time to better able to help you maintain that homeostasis in balance. So it's constantly looking for things that could potentially disrupt your homeostasis, danger or other things that you would have to react to. How does it know what to react to? Well, there's some things that are sort of more innately reacting to like loud noises which activate our stress response. We'll talk more about the stress response and how this is triggered. But some things we learn over time, oh, when someone is running at me and they look really angry and they look like they're gonna punch me, Oh, I should run, I should do something. And so we learn from our previous experiences what is safe and what is dangerous. You have learned from your previous experiences with that alert message on your phone. Oh, 99% of the time is some ambler alert and like, oh, I feel bad for the child who has abducted. Oh, but I don't have to. There's nothing for me to do right now, so does it? You don't need to create strong emotions. You don't need to take action. Okay? And so you've learned to ignore it most of the time. That's sometimes problematic because sometimes like, well, it might be really important, but we learn what is dangerous, what is safe. And the hippocampus takes all of the contextual information to try and learn from our experiences and to set those experiences into our memory. So what happens is when something bad happens and the do like gets all bent out of shape, it says the hippocampus like they're sitting right next to each other. It's like, hey, we should probably remember that for later. And then later, because the hippocampus is constantly scanning your environment for things that are similar to previous stressful situations, the hippocampus is like, oh, hey, this is that time like previously when the professor had a pop quiz, like why aren't there any slides up on the board? Like oh, and then like that nudges the migo, like, hey, we should probably start freaking out about this. And so they work in concert together, and the anterior cingulate is probably the hardest of these to wrap your head around, but it plays a crucial role in attention hoops I need plug my. So like my computer has alerted me that my battery is about to die and my hippocampus is like, oh, well that probably means your battery is about to die. And then you wouldn't be able to present this, these slides and my Migs like, oh my god. And then everyone would think you're a terrible professor and then you might get fired and okay, so that, that information goes to my sum was like, oh, I guess I should just pull my power cord out of here. It's just an example of how it works together. The anterior cingulate is guiding your attention because things that you can perfectly predict and know exactly what's going to happen you don't really need to pay attention to like that's why you can walk back from here to your apartment and not even like pay attention. But if all of a sudden there's like a 60 foot inflatable clown in the middle of West. Oh, like oh that's something and sings like, oh maybe we should pay attention to that. If you walk into your apartment and there's a mysterious person, maybe we should pay attention to that. Things that are unexpected or out of the ordinary. And it's sort of the gateway between the prefrontal cortex and the limbic system as to what you should pay more attention to. And then the prefrontal cortex is involved in all these higher order, complex analytical processing, trying to regulate those impulses. So you're like, no, don't just impulsively eat things to be able to keep information in mind long enough to do something with it, to like plan, act strategically and so on. But the Olympic system, the prefrontal cortex isn't just like one big thing, It actually has different parts. The upper parts are more cognitive and analytical, and the lower parts are more emotional, Which you might think is weird because I just called it the analytical part of the brain. But the Limbic system is like the feeling of emotions. The emotional part of the prefrontal cortex are about about emotions and regulating those emotions. The upper parts also called dorsal analytical thinking about information and the lower parts are thinking about reflecting on regulating emotions. And these are just big ideas to help you understand that there might be some specific nuances where things might deviate from that. There's also this access from the middle to the outside. Where the middle is focused on your internal world and the outside is focused more on the outside world. We have these names that we use to describe these different parts. The dorsal parts are more cognitive and the ventral parts are more emotional. The medial parts are more focused on the inside world, the outside parts are more focused on the outside world. And so we can have regions like the rslateralrefntrzexvrilaalvmdial, just to orient you, just because scientists can't ever agree on simple names for things. The ventral parts that are like near your eyeball are also called the orbitofrontal cortex. So it's just another name for saying the ventral prefrontal cortex. It could be the medial orbitofrontal or the lateral orbitofrontal. It's just different words for the same thing if we come across that. So how does this, I mean, hopefully some of that gives you insights into yourself. Yeah, it is interesting. Oh, that is why I get stuck in these habits and impulses even though I'm telling myself something else. So hopefully all that you're already learning about yourself. But I wanted to share this, this cool research about how our mindset can actually have a huge impact on our actions, on our emotions. And how this is related to all of these things that we just talked about. There's this researcher, Carol Dweck, who noticed that if you give students, I think it was in high school students math test and then later you test them again. There are some interesting differences because some students do on the math tests and they tell themselves I'm not good at math. And then they will do just as poorly, if not worse, on the next math. Whereas some of those students have what she called a growth mindset of like, oh, I'm not good at math yet ad this crucial word yet. Because having a fixed mindset is like, oh, I observe this about myself and I will always be this way is what is implicitly stated in that when you just add the word yet, you sort of acknowledge, oh, and there's the possibility that I might get better at this. And that power of yet is an example of cognitive reframing. We'll talk about that a lot more, where you just like, oh yeah, I'm frustrated, I'm not good at math yet. So if I'm not good at math and I'll never be good at math, Oh. Then I guess there's no point in studying. Oh, if I'm not good at math yet, oh, well then I guess I should study. And that can change how our actions go. And what was shown in further research is that the more that people had this growth mindset, they believed in the power of, yet that showed that there was greater connectivity. The connections were stronger between the dorsolateral prefrontal cortex as sort of the cognitive analytical part, and the dorsal stratum, your habit part. So you have a better ability to change your habits when you believe that you can grow, when you can change. And if you don't believe you can grow or change well, then your habits are just going to keep continuing the same. This happens through neural communication. I mentioned this a little bit earlier about how neurons have synapses. That's the place where two neurons come together. This concept of neuroplasticity is this big idea, that your brain isn't fixed. It is malleable and can be reshaped. One example of that was the experience dependent myelination. That's one way that your brain changes. The most common way your brain changes though, is through strengthening or weakening specific synapses. That's called synaptic neuroplasticity. Plastic here, by the way, just means that things can be molded and reshaped, like plastic can be formed into whatever shape you want. Plasticity is just the fact that your brain can be reshaped. And one of the descriptions of this is neurons that fire together, wire together. Just meaning that the more that you activate certain pathways in the brain, non, non, this neuron, then those synapses get stronger and it makes it more likely that that pathway will be activated in the future. This is just an example of a close up of a synapse. Yeah, we just have about 5 minutes left, just in case anyone is worrying. Released at the synapse is this little chemical called a neurotransmitter. There are tons of different neurotransmitters. The most common one in your brain is called glutamate. We're not going to talk about that as much because it's not as interesting how your brain does most of its stuff, like blah, blah, blah, That's boring. Like 85% of all synapses use glutamate that gets released and it floats across the synapse to the dendrites on the next neuron and they decide what to do with that. But in this class, we're going to be focused on, I think, what are the more interesting neurotransmitters. And we're not going to be focused so much on the neurotransmitters themselves, but the neurotransmitter systems. What do I mean by that? Well, the neurotransmitter is just a chemical. This is the chemical, the neurotransmitter system, all of the neurons that either release or are affected by that chemical. So you can think of it, it's like the difference between an airplane versus like the system map that you see in the back of a Delta magazine that shows you, oh, these are all the places that delta flies. That's the delta system. So the serotonin system is all the places that produce Seratonin are all the places that it goes. All three that we're really going to be focusing on. Seratonin nor nephron and dopamine. Those are the three main ones we're going to be focusing on. They're all crucially important in the proper functioning of the prefrontal cortex. Serotonin plays a huge role in willpower, in regulating your mood. Willpower meaning the ability to override your initial impulse right now to eat a cookie. To be like, oh no, because I'm going to a fancy dinner later and I don't want to spoke on dinner. So that's something that serotonin facilitates. Nor penephrin helps you appropriately respond to stress, which is a good thing. Because if things need to be responded to like oh, my blood sugar is dropping, Oh, my oxygen is dropping. Well you need to do something about that, nor Penn facilitates that. And dopamine, which I mentioned earlier, plays a huge role in the function of the dorsal stratum and the nucleus acumbens also plays a big role in the proper functioning of the prefrontal cortex, which can help you, based on your goals, get more excited about something or override some habit because you're excited about some bigger long term goal. So dopamine plays a big part in enjoyment and reward, or learning and your habits. So those are sort of the main three we're talking about, but there's also a bunch of others that will come up over the course of the quarter, so I just wanted to, um, highlight those. We'll talk about those more as they come up. But there's like, the brain is fascinating because it has some basic functions. Like there's just electrical signals flowing, but all these different regions kind of are pulling you in different directions. All these different neurotransmitters might facilitate different things. So just to wrap up or remind you that this is not just a step you're going to be learning about, you're going to be implementing. And the intervention for this week is to exercise. If you didn't learn that in section, now is your reminder, you're going to exercise at least three times this week, ideally at least five times this week. You will also fill out the questionnaire, the daily log, At least five times. Whether you exercise or not, just fill it out the same time each morning. We'll tell you more about how you're going to do the write up, but just make sure that you're logging in. Just one key thing about the well being questionnaire. So you think of it as a lab notebook. So yes, you answer the questions, but also if you did the intervention, describe what it is that you did and if other stuff is going on in your life that may be affected your sleep or affected your stress or whatever, just jot it down. You don't have to sign a diary, but just so you're like, oh right, my boyfriend broke up with me or whatever or like, oh, I had three mid terms this day. Anything that you think may have affected the data or affected your ability to interpret the data? Thanks. And I'll see you next week. Yes. Also quick intervention.

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# Week 2 lecture 1

Okay. Oops. Okay, so go ahead and get started. Welcome back. Sorry if you got confused, if on brew and learn there was some confusion from spring quarter, but if you're here then you probably didn't see that and you didn't get confused and Perfect. Yeah. One of the things that I want to make sure everyone is aware of is the weekly log that's due tomorrow before section. I'll just mainly a reminder, there's the video on week two of Bruni. Spend 10 minutes talking about a little bit more of the details. An example that might help give you some guidance, but the basic idea is you've been collecting data about yourself all week. You've been checking off, you've been filling out this daily questionnaire as you've exercised. Some days you have an exercise. So you filled out the questionnaire, you say, oh yeah, I exercised yesterday. And you answered all these questions. That information should be E mailed to you. You can also keep track of it separately if you like, but then you just pick whatever variable you're most interested. Oh, I'm interested in how is this going to have effect on my positive emotions. Okay, well, look at the cheerfulness variable. Oh, I'm interested in how exercise is going to affect my sleep. Ah, well then look at that variable. I can't tell you what you are most interested in. Sometimes students are like, so which one should I pick? And this is where this class I think is most applied and most relevant to you is like, well, you have to do all of this work anyway, right? Like you could get a good grade just by doing the work, but as long as you're doing the work, you may as well also learn about yourself. And use it to apply to your own life and actually be happier. So if you're wondering, oh well what is exercise helping me for? That is why you're doing this information. I think it's a very important thing to notice about this class because yes, you could get a not ever reflecting truly on yourself, like we're not grading you on how happy you are. You could just fill out the questionnaire and not actually think about how happy you are, but like that would be an entire waste of your time. So as long as you're doing it, you might as well use that reflective capacity of the prefrontal cortex to actually think, oh, what am I interested in? How could this help me? That's, I think the most important thing about science. It in fact, took me a long time to realize because I originally, I just worked in a lab and I would just, do you know what my boss told me to? And then when I was in grad school, I was sort of like waiting for instructions. And the head of the lab was like, well, what are you interested in? And I was like, I don't know, lots of stuff I can do. What do you want me to do? Uh, and the sooner in life that you can actually start to pay attention to your own curiosity, the better. We often don't do that because you know we get rewarded for jumping through certain hoops. And it creates frustration when we start to think about, oh, but I actually want to learn this oh, but I'm not encouraged to do that. But it's still crucially important because your life is not school. And that's one of the takeaways I think I want you to get from this class. So you're essentially just, you pick one variable and then average the numbers on the days after you did the intervention. And then you're going to average the numbers on the days after you didn't do the intervention, that's your control days. Those are two numbers and you're going to compare. In the results section, you're going to state those. And then the discussion section, you'll talk about how are those two numbers different. If your cheerfulness number is higher on the days after you exercise than the other day than the control days, then you could reasonably conclude that exercise improved your positive emotions. So that's what the discussion section is, just talk about the data. Um, talk about what you think that means for your life. Talk about what else could have impacted the data. Oh, I, you know, broke up with my girlfriend or, you know, I got really sick. Oh, that could probably have affected the data. I don't know how. But this is the wonderful thing about science that most people get wrong. They think that science is about U getting some arbitrary correct answer that somebody else already has. What science actually is, is an investigation into the Unknown where nobody knows anything. Or rather there are some very smart people over here that think the answer is one thing. The very smart people over here that think the answer is the other thing, and nobody knows who is correct. In this case, you are studying you. Nobody in the world has ever done this experiment on you. Certainly not at this point in your life. So there is not a correct answer to get. There might be a hypothesis that you have, your data may not agree with your hypothesis, but that does not mean you did something wrong. That is why we do science, we have hypotheses like, hey, this is what I think. And then you do the experiment, and then your data either does or does not support the hypothesis. And then you just write and you describe what you did and why the experiment may or may not have supported your hypothesis. And that's all. It's not some like cosmic thing, I have to get this right. Or it's just like you just do this experiment, you explain why you're doing the experiment. You do the experiment. This is the data. The data is whatever it is, it's just the numbers. Talk about why I think those numbers are the way they are. Does it support my hypothesis or not? Yeah, so I explained some of that more in the video, but if you want more detail, you can watch the video. What this lecture really is focused on is stress this week, in general, is focused on the physical things that you can do with your body. Or the behaviors that you can do with your body that regulate stress. Next week we'll talk about some of the psychological factors that regulate stress. But in order to understand like what we're actually talking about, we got to define what stress is. Many of you probably have your own definition of stress. You have an idea of what it feels like to be stressed. The way we use the word stress colloquially and every day language, is not the same as the scientific definition of stress. When you use the word stress, like I have so much to do, I have these midterms coming up. People are expecting to me, I have too many commitments or whatever. Like yes, that is a form of stress. But scientifically, when we talk about stress, it is really the fact that something in your environment has changed that you need to respond. So, you know in the example I was just talking about, well, your teacher, your professor assigns you a new assignment and well, you got to do it or you'll get F This is linked with pretty much everything that we do. Because the stress, the thing that is the oh, a, oxygen levels, it could be a change in blood pressure, it could be a predator that you see approaching to you. Something has changed. Your foot goes through the chair, your professor points out the mistake that you made and now everybody's laughing at you like these are stressful things. And by the way, like when it comes to people like why are, you know, people paying attention to us? Or people being disappointed at us? Or people, you know, arguing like why is that stressful? Oh, because our brain evolved to connect with other people and we need other people to survive. We'll have a whole few weeks on that. And they're all sort of t, to all these sort of abstract things like respect of other people or getting exams done are all tied to the same basic mechanisms as our survival of like, oh, my blood pressure is dropping. Oh, I either need to, you know, cover this wound that I'm bleeding out of or I need to drink some more water or my salt levels are going down or whatever, or my oxygen levels are going down. I need to breathe. And if you don't respond appropriately in some way to the specific stressor, then bad things happen. I E you will die like yeah, at some point you'd like, yes, if you do not respond to the fact that your oxygen levels are dropping, then you run out of oxygen. And your brain needs oxygen to survive. And it needs it to be in this very narrow band of concentration, just like it needs a very narrow band of concentration of salt and water and other chemicals. And if things go too far one way or too far the other way, then you will die either slowly or quickly. That process of needing to be in this narrow band is called homeostasis, which I think I mentioned last time. The process of maintaining homeostasis is mediated by the hypothalamus, which is the central hub of the Limbic system. Things that affect our ability to survive, either really fast or slow, are intimately connected with our emotions. Sources of stress are all over the place. They could be hunger, thirst, extreme temperatures. Because, you know, as Katie Perry warned us, you're hot, then you're cold. Yes, then you're, no, you could be pain. Pain is a signal from your body that evolved to let you know when potential tissue damage is occurring. And if you don't appropriately respond to pain, well, then you'll damage tissue. Unfortunately, as we'll talk about, more like that system isn't always accurate because it can be influenced by your emotions. We can actually increase pain signals, unfortunately. And, um, interpret sensations as pain when it's not actually causing tissue damage. Conversely, we can ignore pain, like if you want to be a good football player, you probably got to ignore a lot of pain of people running into you because you've decided it's more important to me to get this football over the finish line. But that relates to this very complex idea that like we have multiple sources of stress and multiple goals that we are trying to achieve. So like so like in football, you might be trying to achieve acceptance by your peers and you know, thousands of people who you don't know. And to do that you might have to put yourself in danger or in pain at a simpler level, like well, yeah, you have to drink water, you also have to eat food, you also have to breathe air. If you try and do all three of those things the exact same time, that's not going to work out well for you. You'll choke and probably die. You can do them in rapid succession, but it's a complex process because we have all these multiple needs. This is related also to what I mentioned about the perma model in the first class. Like these higher sort of order needs of wanting to connect with people and have a meaningfulness. You know, yes, we have those things and also we have to breathe and eat. And all of these things are potential sources of stress. So you may have heard of Mazlo's hierarchy of needs, it's often sort of drawn as a pyramid. But while we have sort of, all of these needs to reach this pinnacle of self actualization, the research shows that like, well, it's this neat hierarchy. It's not like this video game where you like progress from one level to the next level. Like oh, I have my food and my warmth. Check. Now I can focus on safety. These things are all jumbled up and they can influence each other. If any of your needs, you know, some of these needs might become much more important for a very short time. Like if you're choking and you can't breathe well. It doesn't really matter if you can't figure out what you're going to major in or what career you're going to have. Well, so that's an urgent thing, you have to breathe first, but these things can go out of order. Just as like with the football example that like, yeah, all things being equal, you would like to not be, you know, pummeled by a 300 pounds guy, but you're like, well, my self esteem or my acceptance of other people, just my self actualization of trying to be the best player I can be. Well, that's more important to me than my temporary pain free existence or my temporary safety. So I'm going to choose to prioritize that now. And experience more danger, more pain, because this thing is more important to me. I also, this is why, you know, if you think back to the movie Titanic, why like Jack can value his love of Rose and like not try and get out of the freezing water to save himself, because he's now, he's sacrificing himself so that Rose can stay afloat and stay dry and survive and live her wonderful life. If you were just thinking about this as a hierarchy, you would say, wow, you need to get warm, you got to get out of that frigid North Atlantic water before you turn into an iceberg, before you can start thinking about your sense of, you know, intimate relationships. But no, it's not this hierarchy. These things are all interwoven, I guess I'd say that here. It's not really a hierarchy also because all of these things are affecting our limbic system and our homeostasis. We can sometimes get confused. You're probably familiar with the term angry, where you're just start irrationally, getting more annoyed at your significant other or your friends or your classmates or whatever. Part of the explanation for why that's happening is like, well, because you haven't eaten in a really long time, your blood sugar is dropping. And so you are like, oh my god, you're just not listening to me. I hate you. Those are real emotions. It's just that, oh, if you ate a Snickers bar, then you would probably feel slightly different. So this is how our physiological needs can impact our relationships and vice versa. So that's all intertwined. And also, I should point out what I was talking about earlier of when you're feeling like you have so many exams or so much time pressure on you. That is a type of stress that we call psychological stress. Which is indeed stress, the expectations, commitments that you have. Time pressure, it's just oh, that those are caused by thoughts of things that you have to do. There's also stress that is more directly physiological, like your blood pressure is. Blood sugar is, or whatever they feed in to the lymbic system and the hypothalamus. But it's not always useful to make that distinction. Our emotions are influenced by all of these things. It's just that, oh, they all essentially affect our physiology. Ultimately, the primary source of your major emotions right now, it is caused because your blood sugar is dropping. Well then I should address that more directly by eating a ser Bartim could be. By your blood sugar dropping. But you have a test right now, and so you can like, ah, I get that, I'm stressed because I haven't eaten. But it's more important to me to take this test and pass this test. So it's just helpful to realize like, oh, we have many sources of stress that trigger various emotions, some of which are more initially physiological, some of which are more initially psychological. But because they're all affecting our brain, they all affect our brain physiology. These are not always easily separable because it's not always easy to figure out why you are feeling the way you're feeling. It is much easier to determine what you are feeling. Even that is difficult if you're not used to listening to your own feelings. Like am I feeling angry? Am I feeling anxious? Am I feeling afraid? A feeling grateful, like oftentimes you're feeling multiple things. But it's not so easily separable from your goals and your relationships and your physiology. Because all of these things are affecting your emotions. In the experiment that we having you do, you're just, you're collecting data, like what are my emotions? Collecting data is part of science. What science is, is theories that explain why the data is the way it is right now. So that you could make predictions about how to get that same data or how to influence the data in the future. So you could be feeling tired or sleepy today when you do this scientific study on yourself of, oh, I'm exercising some days, not exercising some days. Well, that's one influence on why you feel tired today because whether you exercise or not also. Oh, I stayed up later last night. Oh, I do. Oh, I drank a lot of caffeine as well. Oh, I have a test this morning. And so I was thinking about that there's 1 million different causes of why you are feeling the way you are right now. But to figure all that out, you got to start with like, well, this is how I'm feeling. And we can't study all of those things at the same time. So in science, you just dumb it down to say like I get it, I get that there's all these different things going into my life. But I'm just going to pick one variable to control. I'm not going to pretend like it's the only variable. Is that the only thing that affects how wested I am is whether I exercise or not. That's just the one that I'm going to control for and look at more closely. And in the discussion section I might say, oh yeah, but there's all this other stuff that was also going on. So because it wasn't a super well controlled experiment, I can't draw, you know, really strong conclusions. Or maybe you did have a well controlled experiment. Maybe every day of yours is exactly the same, except one day you exercise, one day you don't, Well, then you can draw stronger conclusions. But that's part of why we do science in this way, to try and disentangle all of these things. So when you're experiencing stress, it's not always easily separable to know the sources of that. But the reason that we have this stress response and why the hypothalmus functions the way it does is to then mobilize our body to do something about it. Because as I said, stress is an environmental change that requires you to do something. This is one of the primary ways we describe the stress response throughout the body. Is called the hypothalamic Pituitary Adrenal Axis, or the HPA axis. If you're in psychology, you may have heard of that. You don't need to learn about the pituitary gland much. The adrenal gland is fairly straightforward. That's where adrenaline comes from. Just trying to connect this to things that you may have experienced before. When you get that rush of adrenaline, your heart starts pounding. That's because, oh, some stressor in your environment triggered the hypothalmus to trigger this cascade of effects that then release adrenaline so that you would respond. Because these things originally evolved for, oh, there's a lion, I got to run away from that, or oh, there's a stranger attacking me, I need to fight them, or there's a loud noise. What was that? I need to freeze and figure it out until I know whether it's something that I need to fight or something I need to run away from. Um. And that is why another way of describing this activation of the HPA axis is the fighter flight response or the fight flight freeze response. Because this is what happens when we get stressed. We activate this stress response or this fighter flight response that cascades throughout the body. The two main hormones involved in this are adrenaline that I just mentioned, that gets your heart pounding, gets your blood flow in your muscles so you can run, react. But also cortisol, which helps, uh, prepare your body to utilize more blood sugar so that instead of storing away sugar for later, you'd be like, no, got to use the energy. Now, there's a two primary hormones that we refer to as stress hormones. Cortisol, by the way, also inhibits the immune system in the short term. Have you guys ever used, had an itch or a mosquito bite and put cortisone cream on it? Cortisone cream, I'll just on one of you. Yeah. Cortisone cream, anti cream is cortisol. You're having an immune response to this bug bite and you're like, but I know it's not actually damaging to me. So I'm just going to put this stuff on it to suppress that. And it's the same chemical except when it's flowing through your body, we call it a hormone, this fight or flight response that I just talked about. It's this cascade of chemicals and electrical activity through your body's nervous system to trigger specific reactions and physiological changes in your body. The autonomic nervous system is a set of nerves throughout your body. It originates in the brain, but as the nerves that go throughout the body that you could also think of as your automatic nervous system, it controls a lot of physiological functions. There are two parts of it. One part is this fighter flight response, also known as the sympathetic nervous system. That's in contrast to the parasympathetic nervous system, which we'll talk about in a moment. The sympathetic activation of the sympathetic nervous system, which is caused by some stressor, physiological, psychological, whatever triggering the hypothalamus. It's like, oh boom, we need to do something about this. Let's trigger this cascade of effects throughout the body. So one thing that happens is your pupils dilate because whether it's dark out, the primary thing is you want to get in as much information as possible. What that sacrifices though, is it's harder to look at fine details when your pupils are dilated. But if a lion is coming at you, you don't really care about where is its whisker actually located? You spoke to a lion, right? So, we care about these big details. We also inhibit salivation. Why? Because like, well, you Sal, In order to eat food, you're not going to be eating food anytime soon. We need to devote our bodily resources to dealing with this immediate stressor right now because if we don't deal with it right now, there won't be a later increased heartbeat getting more air to your lungs. We're disrupting digestion because stop wasting time digesting food. Let's use all of our resources to address the immediate need. Relax your bladder because it's like, well, let's stop carrying excess weight. We don't need to worry about all this stuff. They are even sexual effects as well. Most of this oh yeah, signals kidneys release. Epinephrine is just another word for adrenaline. They're synonymous. So these are the things that help you fight or flee, or freeze, or do something to survive. And any time that doesn't quite make sense in your current context, it's always helpful to put yourself in the perspective of someone who evolved, you know, 100,000 years ago. Where like, oh yeah, the threats were more clear. All of the threats you face, now, your brain uses the same system. So when you have an exam coming up, your brain's go, oh, it activates the stress response. Some of those activations aren't particularly helpful for sitting still and taking a test, however. But that's because your brain did not evolve for you to take exams, at least in the way that we do now. And that is why sometimes when you activate this stress response, it causes these symptoms that you're like, uh, I don't like this at all. So sometimes your vision might get a little bit blurry if you're having, you know, extreme stress. Oh, that's because it's an activation of the stress response where it evolved to just like try and take it as much light as possible and not worry about the fine details. You're sending adrenaline to your muscles which makes them activate more. Which is why you might feel jittery, really great for running away from lion, not as great for sitting still and filling out a multiple choice tests. If you have asthma, then, uh, stress might trigger asthma. It's why your stomach might start hurting. You have digestive issues. You suddenly have to run out and go to the bathroom. You have to go, you can have sexual dysfunction and, and not be able to perform as you had hoped because you have these activations of this stress response. And so a lot of times it's helpful to just notice or know about these physical manifestations of the stress response. So that when you're feeling something in your body, you're not immediately like, oh my God, I need to go to Web MD. Like what is this symptom? Most of them can be explained away like oh, that's probably stress. And it's really important to know when your stress response is overly activated and isn't being particularly helpful because there's this complimentary set of nerves called the parasympathetic nervous system that does everything the opposite. They work in compliment to each other. So you've probably heard of the fighter flight response, but this whole complimentary system is often referred to as the rest and digest response. Because you think of it, your body has limited resources. Your body has to decide how am I going to allocate those resources? Am I going to use them all right now or am I going to save some for later? Well, if you're being attacked by a lion, there's no point in saving any resources for later. You got to use it now. But if you're always using it all, then that's not good for your long term well being. Because you're never boosting your immune system or improving growth strength while our stress response is necessary. If it's chronically activated, then it gets in the way of this dynamic balance that is needed for growth. What was going to say about this? Yeah, we'll talk about this more later. But stress speeds up your breathing. Sometimes it, if you actually slow down your breathing, you can activate the parasympathetic nervous system and push yourself into this rest and digest modem. This idea of limited resources, you can sort of think of like money. You have a limited amount of money and you want to use that money to say, be happier. Well, if you spend the money now, oh, I could buy Starbucks right now. Oh, be happier right now. If you do that every day, then you're like, ooh, I can't save up enough to buy a laptop, which would also make me happier. So you have to make choices sometimes about how do I use these limited resources. And your brain is constantly trying to find that. Balance. Sometimes it makes mistakes. But the sympathetic nervous system is based on the principle of like, oh my God, use all the resources now. Use all your blood sugar. Do everything you can right now. And the parasympathetic nervous system is like. So let's rest, digest, rebuild, store some resources for later. And so it's doing everything the opposite. Whereas the sympathetic nervous system increases muscle reactivity and dilates your pupils and makes you breathe faster and makes you sweat more. The parasympathetic nervous system constricts your pupils and simulates saliva and does all of the opposite things. By the way, sometimes one of the problems is when you get disconnected from our awareness of our stress response. And so we continually, we're like, oh, I need to motivate myself more, I need to push myself more. And we don't realize like, oh no, you're already kind of in max stress mode and that's just making things worse. Um, so one of the main reasons where have you do these daily questionnaires simply to become more aware of yourself because then you will know where you are on this stress rest spectrum. Stress is something that's probably very relevant to you. You probably know this already. You don't need a scientific study to tell you that. I just wanted to share this study about college students that where they gave them this questionnaire called the Perceived Stress Scale at various points throughout the semester, they did a university with a semester system, you could probably map that onto the quarter system. What they found is, not surprisingly, they did that 45 separate time points across before the semester started, at a few points during it, and then just after the semester is over. And these were the scores that people got on this perceived stress scale. When they asked him how stressed they were. When I think of people started out at this level of stress and then increased as the quarter went on. Probably none is surprising to you. And then it goes, the reason it doesn't go back down all the way to baseline, just a function of how this study was designed, that not all students finished finals at the exact same time. So some of the students had finished finals and they're probably back to baseline. And some of the students hadn't quite finished finals yet and they're still stressed out. But this is probably your experience as well, this is just showing it in this scientific study. But importantly, they didn't just look at their stress. They also want to see, well, how does exercise affect their stress responses? They split up the three groups into various levels of exercise. Some of whom exercised a lot, they called it the high activity group. Some of them exercised a moderate amount, some of them didn't really exercise at all, and they called that the sedentary group. And when you look at these various other measures like the sleep quality, positive affect, there's another way of saying positive emotions or negative affect, or negative emotions or well being. The students who exercise the most were sort of better off at every single time point. So for example, sleep quality, this is an inverted scale. They tried to show for the negative and positive. So like lower scores mean that you're sleeping better. The sedentary people had the worst sleep and the people who exercise their sleep got better throughout the semester. Positive emotions, Yeah, everyone. Positive emotions kind of go down a little bit, except for the people who exercise a lot, well, their positive emotions stay high and even keep going up. Negative emotions for everyone, this is a more clear pattern, negative emotions because you can have high negative motions and high positive emotions. Negative emotions. Peak for everyone in the middle of the quarter, like during mid terms. It's just that a if you exercise regularly, they're just not quite as high. You're starting from lower and you're better off. This other study on exercise was done in older adults suffering from major depression. So in this particular study, they were looking at giving treatment with antidepressant medications. And then randomize people to either get antidepressant medications or get exercise so they could see who would benefit. I suppose I should have made this more explicit. This is, we're shifting from talking about stress in the earlier part of the lecture. Talking about, oh, how exercise can be used to modulate that stress. One of the things they found is that both medication and exercise significantly improved depressive symptoms in these older adults. So even something as simple as just like moving your body more can solve something as complex and sometimes seemingly intractable as major depression. A few things to note about this slide. In this graph, you'll note that the Y axis doesn't start at zero. So that makes the difference look much bigger than it actually is. Because this looks like eight times as big as that little graph, if they actually showed the rest. So oh, it just look twice as big in scientific journals, they do that sometimes just simply to draw your attention to the point that they're trying to make. But in other areas of life, people will often show you graphs that are technically true but visually misleading. And it's just helpful anytime anyone presents you with any data in a graph, the first thing you should always do is look at the y axis. Because visually like, oh my god, that's like five times as much. But if you actually look at the Y axis, we oh, okay. You know, you can temper some of that enthusiasm. But one of the things you can notice, yeah, whether you get medication or do the exercise, like you both sort of start out up here, both groups start up here and go down to about the same place. When we're thinking about science though, that's the data. Okay, did the experiment, that's the data they got. Like why that data is the way it is? Well, you have to come up with a hypothesis and do other experiments and you can draw conclusions. But the conclusions that you draw about the data always have limitations based on the specifics of the experiment you did. This study was done in older adults. And if I said, oh look, exercise is just as effective as antidepressant medications. You guys, if you're depressed, you don't need to take medication, you could just exercise. There are a few problems with that statement. But you can't really conclude that that statement there isn't really supported by this data. Because I don't think any of you here would meet the age cutoff that was done in the study, like these people were all over 60. So you can't conclude that this would work just as well in college students. You might hypothesize that you oh well it worked in older adults. I wonder how it would work in college students. And maybe you could use the previous study like, oh, exercise helped with all these positive mood. Oh, I wonder if it would help with depression in college students. It's a perfectly good hypothesis, but you can't really draw conclusions about this, about anything about college students from this particular study, because there were zero college students included in this study. So it's just always helpful also to understand like, what are the limitations of this study, what's the scope of this study? Because it's very easy to be misled. It's also if you're anything like me, you might think like, oh, well medication was super helpful. And Exercise was super helpful. I bet if someone did both, they would get even better. That's a perfectly good hypothesis as well. And the scientists were wondering the same thing. And they did that arm of the experiment as well, and it just didn't happen to be the case. So yeah, that group who got both medication and exercise, they improved a lot. I don't think there were significant differences between these groups, but you might wonder, wait, but why didn't they get better? I don't know. You don't know either? Nobody knows. We don't fully understand all of the mechanisms. That's a completely other experiment that we need to do. I could come up with some guesses like, oh, well maybe medication had some side effects that actually disrupted exercise, so people didn't get as well. Or what we don't know is if the people who got better on medication and the people who got better on exercise are the same people, right? Like if someone did well in exercise. Well, if we went back in time and put them in the other experiment and put them on medication, would they have gotten just as better? Like, are there some people that are going to get better regardless of what you do? Or are there gonna be some people like, no, only get better on medication and these people only get better on exercise. And we don't really fully understand that, to continue investigating this, to try and figure out why does exercise have this big effect? Well, we should look at what effects exercise has on the brain. We know, oh, antidepressant medications target the serotonin system or the dopamine system. What effect does exercise have on the brain? This particular study wanted to examine the effects of exercise is related to depressive symptoms and the stress hormone cortisol. This was done in adolescents. 49 adolescent females, 18-20 years old, with mild to moderate depressive symptoms. And they were randomly assigned to either do this exercise routine, which was like, I think, take a jogging class to do some light to moderate exercise five days a week, or just stick with your usual activities for the next couple of months. The group A was assigned to the exercise and group B stuck with their regular activities. One thing that you might notice is that group, they're depressive symptoms, more depressive symptoms is worse, means more depressed depressive symptoms went down a lot more than group B. We can conclude exercise helped them with their depressive symptoms. It's also interesting to note though that group improve slightly too. That's an important feature to note. A lot of times when you just start paying attention more to something like, oh, I'm depressed. Oh, maybe I should enroll in this study on depression. Like just doing that can affect the data. This is why sometimes when you're trying something new, it's actually really hard to know is this actually helpful or am I just thinking it's helpful because I've decided to finally do something about my health, or my weight, or my study habits or whatever. And this is one of the reasons, by the way, why we do bigger scientific studies. So you're not just stuck in someone's own perception, because even in a big scientific study, those expectations can have an effect. Another thing that they found is they also measured the stress hormone cortisol. And they found that the exercise significantly reduced the levels of cortisol or sort of the general activation of their stress response. Then after eight weeks, they switched the groups, Then they said Group A, okay? You go back to doing your normal activities in group B, you start exercising now. And what they found is, oh, all of a sudden, group started getting a lot better. Their cortisol went down more. Group A weren't exercising as much, started getting a little bit more depressed. Their cortisol levels went up, their stress levels went up a little bit more. One key point to note here however, is that their cortisol Hmm, Group A, right? So, cortisol, let's say they started at 93, they went down to 61 after two months. The specific numbers don't matter, but it went down by 30% or whatever after two months of exercising and then after two months of not exercising. Back up, but it didn't go all the way back up. And if you look at the depressive Smpoms, yeah, the depressive symptoms got better. They stopped exercising, the depression went back up, but not all the way back up. And that's really important because sometimes we don't let ourselves make small changes in our life because we're like, well, I couldn't exercise forever so I'm just not going to do it. But if you do something for a couple months and then stop doing it, well, you're often still better in a better situation than if you had never done it at all. So don't let the fact that you're not going to keep doing something forever prevent you from, from trying it. U, this study looked at habits as they are in the stratum, the habit circuit in the brain, and how exercise could affect that. In this particular, they looked at the habit of smoking. So they took a bunch of people who are cigarette smokers and they said, okay, don't smoke for 24 hours, they're really wanting a cigarette. And they brought them into an MRI lab, a functional MRI lab, so that they could see what was happening in the brain when they like showed them pictures of cigarettes to trigger what's the word desire to smoke. I'm looking for craving is the word I'm looking for. By the way, functional MRI is essentially a movie of the brain. We will talk about this a lot throughout the course. You were looking at subtle blood flow changes in the brain. So you're not looking directly at neural activity, you're looking at subtle blood flow changes between two different conditions because your brain is constantly doing stuff. So you have to show, so in this study they showed people pictures of cigarettes, but they also showed them pictures of like things that looked like cigarettes like a pen. Just so that they could differentiate. Well, we don't care what is your brain doing when it's like looking at pictures of something? We want to know no specifically, if that thing is a cigarette and you are really craving a cigarette, how much does your brain respond to that cigarette? So functional MRI studies are always comparing two very similar conditions that are crucially different in one important way. In this case, pictures of cigarettes, so everyone stopped but wasn't allowed to smoke. Everyone did the FMRI study looking at pictures of cigarettes, but half the people before they stuck them inside the FMRI machine to look at their brain and they said, okay, just get on this exercise bike for like 10 minutes. Just pedal at a moderate pace. The other group they're like, okay, just sit there. You don't need to do anything, just relax. And at this time point on this graph shows their desire to smoke. Just like, hey, how much do you want a cigarette right now? So before they did the exercise, there was no difference between the groups behaviorally like they both had just, you know, stopped smoking for 24 hours. So therefore they both had the same desire to smoke. Time 0.2 is right after they did the exercise. Just 10 minutes of exercising significantly reduced their desire to smoke. And if you ask them an hour later after the whole experiment, they still had reduced desire to smoke. Reduced cravings relative to people who didn't exercise. And if you look at what is happening in the brain, well, when you're a smoker and you see a picture of a cigarette, particularly when you haven't smoked in a while. It triggers strong cravings, a strong desire to smoke because it's activating your stratum. You have this habit of smoking when you're stressed or whatever. That activation of the stratum, the dorsal stratum is what's pulling you to want to smoke. When people exercised it, reduced the activation of the dorsal stratum. You know, that's not going to, you know, mean that they're gonna quit smoking forever. But like, well, it's a little bit easier to make a positive habit choice if you're not being quite pulled so strongly into that bad habit. So, just 10 minutes of exercise was enough to just reduce the craving. It's not, you can go out, no, I don't know if she's trying to go out there. Exercise also modulates a lot of cool fun chemicals in the brain. So you've probably heard of endorphins before. These are the brain's own form of morphine. We knew about morphine, We've known about, you know, opium plants for thousands of years. Humans, That is, morphine, I think was discovered at some point in the 19th century, like oh, that's why these opium plants are so helpful, it's this specific chemical. And it wasn't until later in the 20th century that scientists was like, oh, that's interesting. This chemical that we take from this opium plant, and heroin and morphine, oh, our brains produce that chemical already. Or something very similar to it, so they call it endogenous morphine or endorphins. This study on the right showed that if you engage in exercise, particularly prolonged exercise, you go for a long run and you're an in shape athlete. Then it causes big increases in endorphins in a variety of brain regions. You're going to need to memorize all of these brain regions, but just pointing out like, oh, the orbit of frontal cortex or the dorsolateral prefrontal cortex or the anterior cingulate cortex. So you get the boost of endorphins everywhere. And this is often what's described as the runner's high. Like oh, all of a sudden you have this sense of euphoria and well being and like your pain goes down. Uh, because your brain is releasing all of these positive chemicals. There's also a set of chemicals you probably haven't heard before called endocanabinoids, but you might be familiar with this root of the word, which comes from cannabis, or the brain's own form of cannabis, or THC, or marijuana. Because any chemical that you take externally to get high for whatever reason, it only works on your brain because your brain has receptors for something that is similar to that. Why does your brain have receptors for that? Ah, because your brain already creates some chemical somewhere that does something similar. Sometimes we're like, oh, the easiest way to get this feeling is to take this chemical externally. But if you can figure out, oh, how can I get my brain to generate itself, then it often doesn't have the same negative side effects. What they found is that if they took trained runners or trained cyclists and had them exercise for 45 minutes, they had boosts in these endicabinoids. It's also correlated with feelings of well being and peacefulness. Maybe hunger cravings. That's great, You're like, oh, exercise gets all these positive chemicals. In this study, they also, however, looked at sedentary controls, people who don't exercise at all. And they had them exercise for 45 minutes. And in that group, they didn't see a big boost in endocabinoidsfany. Maybe there was a slight decrease. It wasn't significant, but it certainly didn't go up. That raises some interesting possibilities. It also creates more questions like what we don't know is, are those runners and cyclists different fundamentally, in some way from the sedentary controls like oh yeah, no wonder you run because it releases all these positive chemicals. And I don't run because it doesn't. So like, is that just a fundamental thing? That it will never release those chemicals? We can't know from this study. So that's why, again, studies always have many limitations like oh, well this is how it does work. We can't know, well, if you started running, how would that change things? My guess is it's some of both. That some people, Yeah, naturally release more pomp chemicals when they exercise. And therefore they exercise more because they enjoy it more. But also it's entirely possible. This is an alternate hypothesis that explains the data. It's also possible that, yeah, when you're out of shape, it causes more pain to exercise and you don't release all these positive chemicals. Which is then self fulfilling prophecy of like, yeah, I'm not going to exercise, it doesn't create these positive chemicals. But it's likely that if you started exercising more, then your brain would start producing more of these positive chemicals. But that's why it's s best described as like an upward spiral. Like yeah, if you started doing it then you would start getting more benefit from it and it'll be easier to keep doing. So if you're like, oh, that'd be nice to create more of these chemicals and you can know that you could have that effect later. It might help you get over that initial discomfort of exercise like, oh, this doesn't feel good. Oh, right. I'm not doing this to feel good right now, immediately. But if I just keep doing it, then I'll start getting all these more positive effects. Not just physical effects, but like, oh, I'll actually reduce my stress and start to feel better and everything. Exercise also boosts this chemical called B DNF, or brain derived neurotrophic factor, which is like steroids for the brain or fertilizer for the brain. It helps grow new neurons in the hippocampus. It helps strengthen and protect neurons damage and from the chronic effects of stress. Too much stress for too long damages the neurons, particularly in the hippocampus and exercise prevents that because it releases BDNF, which protects your brain, just like fertilizer makes plants more resilient. This study found that older adults had more gray matter, more neurons in their prefrontal cortex based on how much exercise they used to do. So they're old people, they'll scan their brains. Not a functional MRI, but a structural MRI just to look at how much brain matter you have there. They say, how much exercise did you used to do? And they can see, oh, well, if you exercise a lot throughout most of your life, well, then your brain doesn't atrophy quite as much. So this is just, we don't know specifically from this study that BD and F had anything to do with it. We just know, oh, exercise does help BDNF boost BDNF. We know that BDNF helps make neurons stronger. Oh, also these old people, their brains were better preserved if they exercise more, probably related to BDNF. We can't necesily conclude that because they didn't actually measure their BDNF in that study. Just goes to show from any one scientific study you can little and they're very narrow. But that's why if you understand how the whole process fits together, then you can start drawing from different studies, and not Neal making strong conclusions, but start having hypotheses about what you would actually discover. I think I mentioned this in the first lecture, but just 15 minutes of exercise on a stationary bike increases blood flow to the prefrontal cortex. Now you know the prefrontal cortex is these regions responsible for emotional control and impulse control. And it's not just increasing activity everywhere. It's particularly helpful for the prefrontal cortex. It also boosts the neurotransmitter Serotonin. Now in this particular study, they didn't measure serotonin in the brain, which is where it would be most useful to measure. Because she's like, wow, I want to know how much brain serotonin there is, but it's much harder to do. You know to ask someone to volunteer. Can I just stick something in your head and extract some serotonin so we can't always do the perfect scientific study. So you do you know, good enough job. And you recognize that there's limitations which is exactly what you guys are doing in your lives. We're asking you to do a scientific study. Is it terribly designed, terribly controlled scientific study? That doesn't mean you can't learn anything, it just means I should recognize that's a terribly controlled scientific study. And that's a limitation. So I can learn a little bit, but I can't learn everything in this particular study. They measured it in the bloodstream. So there are other factors that affect seratonine in the blood. But it's just interesting that, oh, we know that antidepressant medications target a serotonin system and they help with depression. Depression, oh, exercise also helps with depression. Oh, exercise also modulates the serotonin system. That's interesting. Now when I talk about exercise, a lot of times people are like, okay, so how much exercise do I need? So I'll just share that with you so that you know what kind, how much the research shows that it doesn't actually matter what kind. The most important thing is that you do it. So you could do strength training, or playing sports, or aerobic training. Whatever you're going to actually do is the most important part. Ideally, it should be about three to five times a week. Now that number we don't know like, is it better if you do it seven days a week? It's hard to study because if you tell people exercise seven days a week, they might not do it, you know. Is it better to exercise, you know, three times a week for more intensity or it sort of doesn't matter. What matters is the exercise that you do. This is why it's so important to understand your self. I like playing ultimate frisbee. Maybe you guys don't like playing ultimate frisbee, so don't try and play ultimate frisbee if you don't like ultimate frisbe, if you don't like going a treadmill, like don't go on a treadmill, like do the exercise that you're going to do. Because doing it somewhat regularly is what's most helpful. Small amounts can be really helpful. But. If we're talking about what's going to have the biggest impact on your mood or anxiety, specifically, in this case it's depressive symptoms. Well then, yeah, do it for a little bit longer. If you don't have the time or energy to do it for longer, well, then stop worrying about the exercise you can't do, just do a little bit less exercise, but do it regularly. If you do it more intensely, you can get away with doing less. So again, these are sort of averages. If you don't like spending 45 minutes going on a run, that's fine. Like run up and down the, you know, the Jan steps like for 5 minutes. Okay. Like you can do it less, it's more tiring. But you have to decide for you like what works best for me. More less intensity exercise or less more intensity exercise. I don't know. But your brain is different, your circumstances are different. And one of the points here is that the effects aren't going to be immediate. So you can't just be, oh, I'm going to start exercising and then do it a couple times and think you're going to get the maximum benefits. What this study found when they're looking at treating depression with exercise is that even if it helps in two weeks or three weeks or something, it doesn't always help immediately. But if you keep doing it in order to know how much it's going to actually work, you've got to keep doing it for at least ten weeks to see the maximal effects, then you just 7 minutes left, 6 minutes left. I sort of mentioned this before when I was talking about the parasympathetic nervous system. But like when we're stressed, we breathe faster and your brain is constantly monitoring your body to see what it's doing. Interestingly, the brain is basing what it's doing based on what the body is doing. That creates this feedback loop of like you start breathing faster or your muscles get tense and your brain's like, oh, I guess I must be stressed. I just start activating the stress response more. But we can disrupt that sometimes by talking calmly to ourself. There's many ways we can change our thoughts or whatever, but sometimes you can do it more directly by changing how you are breathing. Breathing is really interesting physiological function because like most physiological functions in your body, you do not have direct control over. Like you can't just say, I'm going to speed my digestion up, I'm going to slow my heart rate down. Like you can't just decide to do that, but you could if you wanted, start to breathe faster, faster, or start to breathe slower. And that actually gives you the ability to modulate your stress response a little bit. One way or the other. You don't have total control over it, but if you slow your breathing down, you can actually push your body away. This fighter flight stress response towards the parasympathetic rest and digest response. This works because of this nerve that starts in the brain stem and goes throughout your body to all of your organs. And it's monitoring their activity. And it's sending information up to the brain and going back down to the brain, it's called the vagus nerve, the same Latin root as vagrant wanderers because it wanders all over the body. One of the things that's really interesting is every time you inhale, your heart rate speeds up a little bit, and every time you exhale, your heart rate slows down a little bit. That's something that's known as heart rate variability. This also happens anytime you think of something fun and exciting. Oh, well that activates the stress response and then it speeds your heart rate up. Oh, and then you calm down a little bit and it slows your heart rate down. So your heart is constantly changing, right? It might, on average it might be 60 beats per minute, but that doesn't mean it's beating once per second, like a metronome speeds up, slows down, and the more stressed you are, not only does your heart beat faster when you're stressed, but it beats more regularly. You have what's called reduced heart rate variability. When we slow down our breathing, when we find other ways to relax, it increases heart rate variability. It moves all over the place more. That's just a sign that you're more calm and relaxed. People with depression have reduced heart rate variability. Also people who have had a heart attack have reduced heart rate variability. Heart rate variability is related to your heart health, but it's also related to your emotional. Health. This is something I call biofeedback because like your brain is constantly paying attention to what your body is doing and reacting. And body is reacting to what your brain is doing and vice versa. So we can jump in there by slowing down our breathing and disrupt that feedback. Also, similar things that we can do with our body can also affect the biofeedback, like relaxing your muscles. If your muscles are tense, you're more like you feel tense. If you relax your muscles, that can help break that biofeedback. Sometimes we don't even realize how our muscles are tense. Like we're clenching our jaw or clenching our butt cheeks. We're clenching all this muscle. So that's where stretching or intentionally clenching them and relaxing can push us to that rest and digest. Because you don't realize, oh, I'm inadvertently activating my stress response and making myself more stressed and necessary. Two ways that we do that inadvertently is like how we're sitting or standing, our posture or our facial expression. We don't realize how we're tensing our jar or scowling. There's this really interesting muscle right between your eyebrows called the corrugator supercilii muscle. And when you flex that muscle, it cougs your forehead like corrugated metal and it makes it look like you're anxious or worried or concerned about something. If you paralyze that muscle, say with Botox, then you don't make that facial expression. And then you don't, because you're not making that facial expression, you don't accentuate that feeling as much. You can still have it. But when you make a facial expression of a certain feeling you're having, it increases your awareness of that feeling. So this is why if you're feeling happy and you smile or you laugh, oh, it accentuates that feeling. If you're feeling anxious and frustrated and you show that on your face, well then it increases your experience of that. I say this because sometimes these things can get blown out of proportion to think like, oh, you can just smile your way to happiness. Or just have these power poses. So you can't fundamentally change your emotions, but you can turn the volume up or turn the volume down on the emotions you are already having. So this is why if you are happy, then oh, you should smile and it will make you feel better. I'll talk about this yoga steph next time, because I just wanted to emphasize your intervention for this week is about gratitude, so you can feel free to keep exercising, but it's just not the variable that we're focusing on. One key thing that sometimes students are very concerned about is like, well, when does the week end to start? Like, when do I stop keeping data from last week versus this week? And I'm going to say, it doesn't matter. You will be graded based on whether you have, you know, 40 entries over the first eight weeks. So it doesn't matter if there's three entries one week and seven entries the other week. As far as your logs, write it up on the data that you have. Like if you exercise today but you're doing your log today, well, you may not have that data tomorrow. It's like, don't worry about it too much. You're not going to be graded on how many on your weekly logs, you're not going to be rated on how many entries you have. This intervention, I should have wrapped it up, but your TAs can explain it more. Let's just think of three different people who have done something for you in your life that you appreciated. And just spend five or 10 minutes writing a thank you letter, expressing your appreciation. Explain to them what they did, how it helped you, why you appreciated it. You do not have to send it, but do that on three different days. And that is your intervention for this week. Thank you. Thank you. Welcome the interventions. It's not part of our weekly log.

# Week 2 lecture 2

Okay, so, okay, so this is where we stopped last time yesterday. We had an introduction on Monday. We had an introduction about stress and how it's controlled in the body and what it functions. We're focusing on some of the things that you can do with your body to modulate that stress. One is physical exercise. At the end I was talking about, at the end I was talking about breathing. Today, we're going to be talking more about sleep. But just to review this last part. When you are stressed out, whenever a stressor happens, something that you need to respond to, it triggers the hypothalms to activate the sympathetic nervous system, the fighter flight nervous system. That goes to all these different organs in your body to change what they're doing, to focus on your survival right now. This is when you're trying to take a test and all of a sudden your stomach hurts or you really have to go to the bathroom, or your hands get sweaty or your vision gets a little blurry, or you feel really jittery. You know, whether it's a test or you're on a date. Many of those things are not best adapted to your current environment. But they evolved when your brain existed in a different environment and there are different kinds of dangers. But it's just helpful to realize like, oh, that's just an activation of the stress response. And if it's unhelpful, well then you can figure out how you can push the balance of your brain and your body towards the rest and digest response. Although what often happens is we trigger a thought pattern or a pattern of habitual thinking in our stratum that makes it worse. And then we start thinking about all the terrible things that could go wrong, and it makes us more stressed. But just being aware of that whole process gives you the opportunity to have that awareness and say, oh, well, let me just try and push the balance towards the parasympathetic rest and digest response. One of the ways you can do that is through breathing, simply because when you are stressed, it increases your breathing rate. If you consciously slow down your breathing rate to about four to six breaths per minute, particularly inhaling through your nose, then it can lower your blood pressure, lower your heart rate, push you a little bit towards that parasympathetic mode that works because of activity in the Vegas nerve. Just to give you a context like our usual breathing rate is about, I don't know, 14 breaths per minute when you're not paying attention. So consciously slowing it down. Well, to four to six. That's, you know, one breath every 12 seconds or can help push it down. And these other things that I mentioned, sometimes we're inadvertently tensing our muscles. Well, relaxing those muscles can help push you out of the stress response. Or realizing how you're making yourself more stressed. Like you might already be stressed. But you're exacerbating that stress because you're tensing your forehead muscles. Sometimes you might be happy, but you are showing that on your face. And so you're not exaggerating those positive emotions. And it's not that we can just decide to feel a certain way, but the simple little changes that you can make can just shift the balance one way or the other. Just a little bit. These things are going to happen whether you're aware of them or not, so you may as well become aware of how you can impact them. I put up this slide about yoga because this next portion of what you can do with your body relates to yoga. Of all the 33 things mentioned in the previous slide. Breathing, postural changes, stretching like, well, those are all parts of yoga. So if you like yoga, awesome, you just do yoga and that will help with a lot of these things. I mentioned this yoga study I think in the first lecture, where it was really helpful for depression. There are lots of other studies on yoga, but one of the coolest. Relates to this particular neurotransmitter called Gaba. Gaba is an acronym for, I believe, gamma amino beteric acid, which you don't need to know. Uh, but Gaba is one of the primary inhibitory neurotransmitters in the brain. See, most neurotransmitters in your brain are excitatory. That is when they're released and picked up by the postsynaptic neuron, that is the neuron on the other side of the synapse that encourages that neuron to send out an electrical impulses excitatory. It makes it more likely to send an electrical impulse. Inhibitory neurotransmitters do the opposite. They're like, no, no, calm down, chill out. Don't send an electrical pulse. Most neurons are getting inputs from tons, thousands of excitatory and inhibitory inputs. And it averages that all together and sort of decides, okay, I'm going to send out an electrical pulse or not, if this balance between excitation in the brain and inhibition is crucial. Because if you don't get it right, you will die. Fortunately, you don't have to worry about that very much because your brain and your hypothala does most of that for you U, but just sort of as an example, if there's too much excitation in the brain that can lead to se, uncontrolled seizures and then you die if there's too much inhibition that can inhibit your basic survival functions like breathing, and you can fall into a coma and die. These things happen in a narrow band as it relates to your well being. It's even more subtle, but one of the things that researchers notice is that these medications that help with anxiety, anti anxiety medications like Valium or Xanax, which help people who feel a little calmer take the edge off anxiety. They work because they target this Gaba system. They just turn up the volume of the inhibition just like a little tiny bit. Not enough that you fall into a coma, but enough that you're like, oh, feel a little bit more relaxed. It's also perhaps, you know, why you shouldn't operate heavy machinery on them because you might be a little too relaxed. It's also why you shouldn't, you know, mix them with alcohol because that, again, can be too relaxing. I realized I missed an opportunity for a yoga joke. I just put that together. There's studies on yoga that show that it's really helpful for reducing anxiety. But this study wanted to look at, oh, well, does it help with anxiety in the same way that medications help with anxiety? They had people do 90 minutes of yoga, which included this slowing down of their breathing to five breaths per minute. For 12 weeks, they saw significant improvements in people's anxiety. And these were accompanied by increases in gamma Aminupuric acid levels. There's another way of using MRI that's called magnetic resonance spectroscopy. We're not going to go into it a lot, but basically they can look at a little tiny part of the brain and figure out, oh, is there more of a particular chemical or So they had people do these behaviorally, they're doing this yoga intervention and they can ask them, how's your anxiety? And so that's pretty straightforward. You just see fill out a questionnaire. Their anxiety is less understanding the mechanism of how that works. Oh well you got to measure something about the brain and see how that correlates with their changes in anxiety levels and so on. The So this shows, what is this showing? The Beck Depression Inventory, there were significant improvements for both a low dose yoga group and a high dose yoga group. They also found significant changes, significant increases in Gaba in this same neurotransmitter system that's targeted by anti anxiety medications. They found a significant increase in the low dose group. Why not the high dose group? I don't know. They didn't really know either. Like it's because I would say any real world intervention that you're having, it's going to have multiple effects. So maybe they didn't see it because it was noisy. Maybe doing too much yoga. Yeah, it still helps with their anxiety, but it's helping you because you're doing more exercise and it's not as relaxing. I don't know, there's no fundamental way to understand how it all fits together. But it's sort of interesting that, oh, we know these anxiety medications target the Gaba system. Oh, yoga, which helps with depression, also helps with anxiety. Oh, in some instances also targets the Gaba system. It's possible that there was just no ways, and that's why I didn't se, it in the high dose group. It's possible that it doesn't work the same way in everyone. For some people it could be that yoga is really good at activating your Gaba system. And other people it's not. It's just that we don't know ahead of time. Or are you the person who should do yoga for your anti anxiety? Oh, but you know, you might need to do some more breathing or you might need to take medication. We don't know. But these are different tools that we can use. Hopefully, you're utilizing your gratitude letters. It's the intervention for this week. But that summarizes what we didn't cover at the end, Oops, of last lecture, science. In this lecture, a little bit later on we're going to talk about sleep. But I just want to start a little bit more broadly about how we learn things in science Truth. This study was something that I remember. I have a vivid memory from when I was a kid. My dad was a big nerd and he subscribed to Science Magazine. I remember him seeing this cover, what is it from 1994, and I remember like seeing, whoa, that's cool, what is this? It the story of something that happened in the 19th century that they didn't really fully understand until we could have more advanced techniques. There was this guy, I can't remember in what year. Sometime in the late 19th century when they were building all the railroads. And his name was Phineas Gage, really wonderful name. And his job was to be a part of the team that used dynamite to blast holes so they could lay down railroads. But one day something went wrong and someone else forgot to like cover the blast or they put too much explosives or something. And when he went to trigger it, it shot a 1 " thick metal spike through his head. And the spike landed like 100 feet away and he had a hole in his head. And I'm sure there were many accidents like that that happened all the time. But the interesting thing about this one is that he survived and not only did he survive, he actually never lost consciousness. He was messed up. He was upset by it. But like he made a full recovery and he was perfectly healthy afterwards. It's just that as time went on, people noticed that he had personality changes. Whereas before he was like a really conscientious worker. Except, you know, maybe for this one time where he forgot to check that the other guy had loaded the explosives, right? But he had been on time and he was really conscientious and he was like a nice thoughtful guy. And after the incident, he became a lot more impulsive and irritable and couldn't hold down a job as well. He became an alcoholic. And you could say, ah, well, it's understandable from the trauma of like having this explosion. But Um, one of the things that they did in this particular study, the reason why they were looking at this in Science Magazine, like 100 years later, is they're like, oh, well, we could use his skull to try and reconstruct how the rod went through his head and know which part of the brain was destroyed. And what they found is that the orbitofrontal cortex, which is a key part of the prefrontal cortex closest to your eyeballs, Like the orb of your eyeballs, it's the lower part of the prefrontal cortex. This was damage and this is a key part of what we need to modulate goal directed behavior. That is to like, oh, have a goal, some long term goal. If like, I want to hold down a job or I want to buy a house. And then override our impulses and habits to get that goal done. And if you damage the orbit of frontal cortex, then then you're not regulating your habits and impulses much, then you become much more impulsive. So this is one piece of evidence that helps us tell that story that I just told you. The story about what the orbitofrontal cortex does is something that helps explain the evidence that we observe and make predictions about the future, about experiments that we haven't done. Like if I damaged your orbitofrontal cortex. Well, based on this story I could say, ah, well then that probably wouldn't be good for you and you become more impulsive, like it can make predictions about that. In science though, we just don't call them stories. We call them a theory is something that explains all of the data that you've observed and then makes predictions. We use data to support these stories. If you have no idea what's going to happen, you would call it a hypothesis. If your hypothesis is confirmed many, many times, then you're like, okay, that's a pretty good story, a theory that we can stick with. It's just that the evidence that supports those theories can come in a variety of different ways and some evidence is stronger than others. So this is what we would call a case study like yep, he seemed to be fine, and then after this event happened, he was more impulsive. Okay. So if I was saying the story, oh yeah, that's because it's his orbit of frontal cortex. Well, this data supports that story. It supports that hypothesis or that theory. Someone else could be like, oh yeah, that sounds great. I think it's because, you know, he went through this traumatic event and I have some other dude who went through a different traumatic experience and he also became an alcoholic. Okay. So that doesn't necessarily refute my story, it's just evidence for a different story about why he became an alcoholic. So part of the problem with individual case setties is that we can't really control all of the variables. They're just something that happened. We just kind of observe what happens and kind of make up a story about it. But it does support this story that, oh, the orbital frontal cortex is involved in this. It's just not super strong evidence. There's other ways of gaining evidence in that you could do a more, a rigorous controlled observational study where instead of just like looking at one person and seeing what happens, you're looking at a whole bunch of people. Just retrospectively looking at someone's individual case is one example of an observational case study. It's just an observation of one and you can have a bigger person or observe a bunch of people. In this particular study, they did structural MRI. Again, I should emphasize this. A structural MRI is like taking a picture of your brain and saying, oh, there's a picture. A functional MRI is like taking a whole bunch of pictures really quickly. What do we colloquially call that? A movie, Just like a movie might be slow, lower resolution than a single shot. Functional MRI is often lower resolution. It's more pixilated than structural MRI. Why is it helpful to take a movie of the brain? Oh, well, it just so happens that oxygenated blood and deoxygenated blood have different magnetic properties. And so if you take a movie of the brain while someone is doing something, oh, then you can see subtle blood flow changes. Uh, that's as opposed to structural MRI, which just looking as like how big is this part of the brain? So in this particular study, and those are just different ways of looking at the brain, in this particular study, they did a structural MRI comparing people with online gaming addictions to people without. So they just had a questionnaire like, hey, are you addicted to online games? Like you felt a whole bunch of things like, yeah, stay up super late at night playing these games and other people are like, no, I don't. And so the just let's just scan these people's brains and see if there are any differences. It's an observational study because all they're doing is asking you questions about your behavior already. And then they're just scanning your brain to see what your brain is. Like, they are not, uh, assigning you to like, okay, you're going to start playing video games for the next two weeks. They're just observing what is happening and seeing what they can learn. What they found is that people who had these online gaming addictions had atrophy in the orbitofrontal cortex. That is, when they looked at the orbitofrontal cortex, it was smaller in people with online gaming addictions compared to people who did not have online gaming addictions. Even me using the word atrophy. Well, that kind of hints at one explanation for why this is the case. Observations can tell you what is the case, what is true. And this is a very important thing about science. Actually, it took me a long time to understand it, that in science there are facts and there are theories or stories that explain those facts. In science, theories are more important than facts. Why it might seem dumb? Well, it's really easy to collect a bunch of facts, right? Like oh, the sky is blue. Oh, there's you know, 200 people in the audience state like oh, right, we can just observe things, the millions of facts out there. But why are things this way, and how could we change them or what might happen to them? Well, that is something else entirely. That's what a theory explains. Like there are, say, 200 people here. Well, why are there 200 people? What would we have expected? Well, there's 260 people enrolled. Oh, well, there's 60 people who aren't here. Why aren't they here? Well, there's probably a lot of reasons, uh, some people might be sick, people like, but to be able to explain why our observations are the way they are, that is when it becomes science. And a lot of times people you might hear like, wow, that's just a theory. This is the fact theory explains many facts and also facts that we have not yet observed and can make predictions. You could just have a fact sure. But what's the relevance of that fact? Why is that fact important or unimportant? If you don't have some story to tell yourself about that fact, then it's kind of just sitting there. And a lot of times people will tell you stories that are supported by like, oh, like one fact and also a lot of your preconceived notions and biases. And those stories sound really convincing. To make it science. You're like, okay, well, which of these stories is better able to explain all of the facts that we have? Just because some theory is good at explaining one little fact doesn't mean that it's the better theory. So that's a very important thing to understand about science. So one story that I can tell you about this is like, oh my God, people stop playing online games. You are damaging your brain. I can use this evidence to support that story. And if you're already like, oh yeah, it did seem bad for me, you'd be like, well, it's a fact, right? The brain is smaller, that's just a fact why that is the case. Well, that would be the theory and that would also mean maybe you should do something differently or not. Because if you believe that online gaming is damaging the brain, uh, well, then you should stop online gaming. But there's an alternate story, an alternate theory that also explains this fact, right? There's a fact. On average their brain region was smaller here an alternate hypothesis or an alternate theory would be, Oh, some people just were born with smaller orbitofrontal cortesesyjust. Their orbitofrontal cortex for whatever reason just isn't as big. Those people are more impulsive and therefore more likely to become addicted to online games. They can play as much online games as they want. In fact, it's better that they're playing online games because they weren't being impulsive. With online games, they would be doing something else, stupid and impulsive, either that you know bad for them or bad for other people. So these people should keep playing online games. Those stories make completely opposite predictions. Both of them, however, are supported by this fact. Which story is true? Well, you need to collect more facts. So this is just one study and just one fact. And it can support either of those theories as still an observational study because it's just examining people. But it provides stronger support for a theory than say, and, than an individual person because, oh, now we're looking at 50 people. So it's better evidence. There are two basic types of scientific studies that provide evidence. There's observational studies and experimental studies. The case study that I just gave you of Phineas Gage and it's bigger. Observational study are both examples of observational studies. Just one is bigger than the other. You're doing an observational studies, you're just as a researcher, observing what is happening or what has happened and you're just, you know, writing down some measurements, for example. Do people who exercise more have better sleep? I could just pass out a questionnaire right now and ask how much do you exercise? And I could ask, how much do you sleep? Well, that would be an observational study that would, that would give me a number. It would say, oh, well, these people exercise, you know, for 5 hours a week and they get 8 hours of sleep a night. And these people exercise on average 1 hour of sleep and they get 7 hours of sleep at night. Okay. Well, those are just facts u, what you don't know from an observational study though exactly is like which direction it's working. Like is one causing the other or is it the other way around? From the observational study of the online gaming addiction, I know I can see that it's probably related to the orbitofrontal cortex is somehow related to online gaming addiction. That's why there's a difference between these two groups. But I don't know how it's related. I don't know if the online gabing is causing the brain to get smaller in that region, or is the brain region causing people to become addicted to online games? Observational studies can be really informative about, you know, there's something there, but they aren't good at telling you the causal mechanism. We do them a lot because sometimes the only thing you can do, like we can't go back and say, like, what if we blew up a different part of Phineas Gage's brain? Like, you can't do that. Sometimes you can only do observational studies. Sometimes observational studies are done because, oh, I could have some people fill in an online questionnaire and I could do it on 100,000 people. Ah, it might not tell me about the mechanism, but it might tell me some other really interesting stuff. But to actually go out and get 50,000 people to start playing video games and 50,000 people to stop playing video games, Well, that's a lot more difficult. It might be a theoretically better study, but you might not be able to do it in experimental studies. Researchers apply some intervention, some change. They say, okay, I'm going to take half of you and say, you guys play video games for the next week, and I'm going to take the other half and say, you guys are going to do something else for the next week, or you're not going to play video games, you're gonna stick with your regular routine. Then I make observations before and after. But because I experimentally manipulated something, if there's an observation that changes as a result, I can reasonably conclude, oh, that's because of the change that I made. So an experiment can reveal the mechanism of how two variables are related. Observations just show you. Yeah, they seem to be related. Experiments can tell you the mechanism of how. So for example, this graph I think from USA today shows that exercise is linked to good sleep. Because they can ask people, you know, how did you sleep last night? And so this is showing you the percentage of people who reported good sleep. And they ask them how much exercise they got. You see, oh, the people who get vigorous exercise, we 67% of them like yeah, slept really wells. The people who are sedentary don't get really any activity. Uh, well, only 39% of them are saying they have good sleep. Oh wow. So we should tell people to exercise more. Well, that's where it gets uncertain, because it definitely seems like these two variables are related. But how are they related? You can't necessarily draw a strong conclusion because this is simply an observational study. One story you could use to describe this data is, yeah, exercise improves sleep. And people who exercise more get better sleep that is supported by this data. Another story that I could say or someone else could say is, oh, people who get better sleep have more energy to exercise and so they exercise more. That's kind of also supported here. Yeah, no wonder those people are vigorously active because they're sleeping really well, They have lots of energy. And these people are not vigorously active because they're sleeping poorly. And so it's important to know, is something an observational study or is it an experimental study? And oftentimes people will show you an observational study and they'll tell you, see this supports this, and this is why we should ban this, or why you have to do this. And you should ask yourself critically, oh, well, it could be the other way around. And experimental studies provide better evidence, although it's not easy to say that. Because like, well, if you had an observational study of 10,000 people and an experimental study of four people and they were kind of giving you different information, Which one you should you believe? Well, you can't really, No, but it's helpful to think of science as kind of like a court room. Well, we have video evidence showing this person at the scene of the crime, and their cell phone records, and, you know, the DNA was a positive match. Oh, but their fingerprints were somewhere else at the same. Then they have an alibi, Like something happened, but like okay, DNA, that's a pretty good piece of evidence and like fingerprints, that's a pretty good piece of evidence. And like, oh, eyewitness testimony, that's not as good a piece of evidence. You have to weigh all the pieces of evidence to decide, well, what is happening. And that's the same thing that's happening in science. It's just that pieces of evidence are individual scientific studies. Um, and some are stronger pieces of evidence and some are weaker pieces of evidence. Also, when you're writing your weekly logs, a lot of times people will use the language like, oh, my hypothesis was wrong. You actually can't know if your hypothesis was wrong. You're like I thought exercise was going to help me, but I guess my hypothesis was wrong. Well, it's a terribly designed experiment, it's very limited. You can't actually know. All you really know is that your data doesn't support your hypothesis. That from everything else you know about research and other people and from everything else you've observed about your own experience. You could hypothesize like, oh, maybe that's just 'cause I only exercise twice, or maybe that's just 'cause I'm really out of shape. You can't actually know definitively until you keep doing more experiments. And that's why science is not just about memorizing a bunch of facts, it's about looking at a bunch of things and be like, I don't know, what do you think? And they're like, I don't know. Like maybe it's this. Well, you have to do an experiment to find out. So if you looked at that previous study of exercise and sleep, and you're like, I bet it's because exercise improves sleep. Okay, well then you need to do a study to test that hypothesis. And in this case, these researchers did that they had 17 adults who are over 55 get 16 weeks of sleep hygiene education. We'll talk about sleep hygiene in a moment, and then they either got exercise or not. What they found is that people who did not, so this is the baseline and then post intervention, this is showing their scores. Quality their sleep wise. Higher numbers mean more sleep disturbances before the treatment. Both groups were kind of the same after the treatment. The groups who did the exercise, well, they got significantly better. Ah, well, that provides evidence that it's exercise is improving sleep and not the other way around. You could do a totally different study to look at. We, could there be evidence for the other thing? For most of these things, often it is both that there, yes, exercise improves sleep, but also sleep improves exercise. Or yes, maybe online gaming does cause some damage, but also some people are more likely to get addicted to online games. And that is why I like to describe it as a spiral, upward spiral or a downward spiral, because often these things are not neatly separable. But this idea of what kind of conclusions you can draw from data is really important, not just in science, but in all areas of your life where someone's trying to convince you of something using an observation like, oh, well that's interesting. Like all of you know the stock market is crashing. And also this other thing happened like, okay, but like did one cause the other or not? Well, that is a separate question that only an experimental study can answer. So here is a really interesting fact, really interesting observation that violent crime is caused by ice cream consumption. The more ice cream people eat, the more violent crime there is. So the only thing wrong with what I said was the causal attribution there. But we can know just from looking at crime statistics and looking at the sale of ice cream. And we can draw two lines. And we can see, wow, those are really strongly correlated. There seems to be something going on there, but we can't know exactly what or how they're related. So I could say y all these people eating ice cream, they're hopped up on sugar and they're committing more violent crime. Oh, that sounds plausible. Because it sounds plausible. You're like, oh, oh, I guess we must tell people stop eating ice cream. Uh, you know, another way of describing this is, well, it's possible that, you know, because there's all this crime happening, people are trying to calm themselves down by eating more ice cream. Okay, that's possible too, a better. And you're like, well, which one of those is true? You can't actually know from this data, you can't know. It doesn't support one way or the other. My guess, however, is that it has nothing to do with one causing the other and everything to do that, both are caused by something else entirely. I the temperature or, you know, some other aspect of the weather because both of them increase during the summer. So they're not actually related at all, they're just both related to the time of year. And ice cream consumption goes up during the summer and violent crime goes up during the summer. Maybe one is related to the temperature, maybe one's related to, you know, the number of hours of day late, or the fact that school is off. We don't know, There's lots of other stuff. But the key takeaway here is probably something you've heard before, which is this notion that correlation does not imply causation. That if someone gives you two facts, two observations, like look at this, look at this, and they're so correlated, No matter how convincing the correlation, you cannot draw a strong conclusion. Anytime someone is trying to spoon feed you a strong conclusion, you should just question like, oh, they're probably trying to manipulate what I'm thinking and you can look for counter evidence. This doesn't mean you need to yell at them or be a \*\*\*\* about, it just means, you know, for your own sake, just recognize that you cannot draw conclusions simply from observational data. And if you want to play around with this, there's some websites that will show you spurious correlations of the number of Nicholas Cage movies correlates with swimming pool drownings or other facts. Because sometimes when we see a correlation, it means one of four things. Either A causes B or B causes a. Or both of them? As in the ice cream violence example, both of them are caused by something else entirely, like the summer, it's random and there's no connection whatsoever. As in this case, it's a spurious correlation. Meaning if you just make enough observations and just compare a whole bunch of them, yeah, you'll find correlations all over the place. Just because two things are correlated does not mean that they are in any way causally related. But you can't actually know just from looking at that. You have to think critically. So now this second half of the lecture, we're going to focus on sleep. And one of the questions people sometimes wonder is like, how much sleep do I need? And when I was in college, I actually worked in a sleep lab. And our professor told us the answer, which is that college students need on average 8 hours and 24 minutes of sleep. That is a fact, an observation that is gathered from running, you know, hundreds or thousands of different students and people of all varying ages through a whole bunch of studies. And you can come up with an average of that number. But in actuality, it's a bit more complicated than that. It doesn't mean that this number is wrong. It's just, well, what do you mean by the question? On average, you know, what does the average student of, you know, college age, how much sleep do they need to get such that on very sensitive sleep tests there are no discernible deficits? Well, that's the number, that's the answer to that question. But that does not mean everybody needs that or it doesn't mean everybody needs that to function in their life. This is just, oh, well, if we have really sensitive measurements of attention, all these things like how much sleep do they need, such that we don't see any deficits. But is this relevant to your specific situation or not? Well, that's a separate question, and that's where sometimes science and a theory can be, like the study on antidepressant medication or exercise is helpful for treating depression in older adults. That can be true. It might not be relevant, specific situation if you are not depressed or if you are 65 or older. So that's why it's so important to real. Oh, certain things are true, but they may not be relevant. The story that we tell ourselves about the fact is what makes it relevant or not relevant to us. One of the things that this chart shows is how the amount of sleep that we need changes over your lifetime. When you're a baby, particularly a newborn, you need a ton of sleep. It's just unfortunate that it doesn't all happen at the same time. So, like newborns, 16 hours a day, it's just that they'll sleep for 45 minutes and they'll be up for an hour and then sleep again for 2 hours. And so, it's not conducive to your happiness, but they do get a lot of sleep. Your brain needs less sleep as time goes on, and by the time you retire, you know, you might only need 7 hours of sleep. So these are some of the trends that we see. We, we also know is that there's a lot of individual variation and that's why there's a range at any age. We see here that some people don't need as much sleep, and some people need more sleep to function optimally. So 8 hours and 24 minutes, okay? That's a guideline. On average, if we took everyone in this room for their optimal sleep level, that's probably where we would get you. But some of you need more, some you need less. Uh, and if you don't get enough quality sleep for your unique brain, then you enter something called sleep debt, which means that you have some negative consequences. Just like, you know, if you're sprinting and you don't get enough oxygen for what you need, you're going to need to, you know, stop running. Or if you don't get enough food for what your body needs, then you're going to start losing weight. Or other systems in your brain body aren't going to function. Properly because sleep is a physiological need that we have. Unfortunately, it doesn't work quite linearly that if you get 5 hours of sleep every night and then try to make up for it by getting 12 hours of sleep on the weekends, the 5 hours of sleep that you got at night, that did cause more stress. So yeah, it's helpful to make up for it, but in some ways, like you can't just make up for it because it's better to get, you know, consistent amount of sleep the whole time than to get very little sleep and then try and make up for it later. But one of the key things about the relevance of science for your life that's really important to understand is that like scientific studies ask very particular questions that may not be the question that you want to know the answer to. The scientists are like, what is the amount of sleep such that such that getting more sleep wouldn't benefit you at all on these very sensitive measures. What you're probably interested in is how much sleep do I need so they don't fall asleep in class? Right? Like you don't need to reach your optimum level of brain function. You just want to not fall asleep in class. So you could probably get by perfectly fine if your brain was operating at 90% capacity. Like does it matter if it's 100% versus 90% Well, it matters a lot if you are a sleep researcher trying to understand these deficits. It matters a lot if you are an Air Force pilot or a Formula One race car driver, where like any lapse in attention at all is catastrophic for you. Does it matter if your brain is functioning at 100% optimally or just 94% Probably not at all. You might space out for a moment, but guess what? I'm probably going to repeat myself, that's a joke on me. Like something could be true. It could be technically true that your brain is deficient in some way, but it might not actually be relevant to what you are trying to accomplish with your life. So just as an example, in this particular study, they use this very sensitive measure of attention. Where you like stare at a computer screen and every once in a while like something flashes up. And like if it's the right letter, you're supposed to press it really fast. And if you're really sleep deprived, you'll like space out for a moment. That's why, like really bad for, you know, race car drivers. But one of the things that they do in sleep studies is they always make sure people are starting from the same level of sleep. So like two weeks before the study starts. So they're like, okay everybody, you gotta get 8 hours of sleep. Sometimes they bring them into the lab because we want to make sure that everyone's starting from the same place. So they're starting from a place where they are really well rested. And then they divided people into three groups. They had an 8 hours in bed group, a 6 hours in bed group, and a 4 hours in bed group. Now, 8 hours in bed is not the same as 8 hours asleep. It's just, it's easier to measure how much time someone is in bed versus like doing a whole EEG and measure how they sleep or not, how much of the times they wake. So like that's just what they stuck with. One thing that you would notice perhaps about the studies that like, yeah, these 4 hours and 6 hours group go up into this red zone where they're having a lot of lapses of attention is what they referred to. Does anyone notice anything else about this graph on any observation? Yes, there's a pretty big gap between 8 hours and 6 hours over here. Yeah, So there's a big gap here between 4 hours and 6 hours. Yeah. So that's true. You can look at that. Yeah. Okay. That's true. Like why is that the case? That's another question. Any other observations that people make about this Yes. Back there? Yeah. So if you can hear that like even people who are getting 8 hours in bed, well, they're still creeping up into this territory because they're not actually getting enough sleep, they're just getting 8 hours in bed. So one of the other things that you can observe, if I Uh, I'll point these out to you. Is that like even after, let's say three days of doing this paradigm, where one group is getting 4 hours of sleep and the other group is getting 8 hours or sorry, 8 hours in bed. Yes, technically the four hour in bed group is doing worse, but like barely. And this is after three days of getting 4 hours less sleep per night. And if you compare the 6 hours and 8 hours group, even after five days like this is 2 hours of sleep extra, they have access to a night. Like there's really no difference between those lines at all. So if you're talking about the short term, where you're starting from, you generally get enough sleep as everyone did in the study at baseline. Well, then, no doesn't really matter if you only get 4 hours of sleep a night for a few nights. It's not that deficient, But sometimes we're like, oh, but technically, oh, there's a deficit, I know I'm deficient. And then we bend ourselves all out of shape. We're just realizing like, oh, well, if I'm generally getting enough sleep then like huh, a few hours here or there won't matter. So the problem with most college students is that you're constantly in sleep debt. Because you are constantly never getting enough sleep. Or you're having poor quality sleep and then you're trying to make up for it on the weekends, which also inhibits the quality of your sleep. And you're worrying about any individual variations. Oh my God, you need to get more sleep tonight because I have a test tomorrow. Well, if you have generally good quality sleep, then if you sleep poorly before a test or before a big game, it's not going to affect you as much. So we've mentioned this thing a few times, and I just want to highlight it here about sleep quality. Because what matters more for your lived experience, not some technical measure on a scientific study, but even for that it matters is that the quality of the sleep you get is more important than just the, the amount of hours that you get. And that's because when you fall asleep, it's not like your brain turns off. It's doing a lot of complex stuff, you're just not aware of it. The complex stuff that your brain is doing, we call sleep architecture. This is often measured with EEG, which is electrical recordings from your scalp. It's telling you something about what your brain is doing. What generally happens is when we fall asleep, we go into what's called stage one or stage two light sleep that has a certain signature pattern of your electrical activity. As time goes on, you get deeper into sleep. That means if someone tried to wake you up, it would be harder to wake you up. But also on the EEG, the electrical patterns have these big up and down waves. So that's called slow wave sleep or deep sleep. What that actually is in the brain is sort of like a screen saver. When your brain is awake, all the different neurons are like doing lots of different stuff. When you are in deep sleep, they all start doing the same thing. And that's why we can measure it from the surface of the head. Because when they're all doing different things, they're going in different directions. When they're all doing the same thing, they have these big slow waves. And then you enter something called Rem sleep, rapid eye movement sleep where your eyes start. I don't know why I closed my eyes. You can't see what my eyes are doing. But your eyes move all over the place and the electrical activity looks like you are awake. And this is the stage of sleep where it's most conducive to dreaming. That whole process takes about 90 minutes on any individual person. As this shows you here, oh, there's some little noisy thing, oh they wake up a little bit, whatever, like that's generally how it works. You go through stage 1234 and Rem sleep and then back 1234 Rem sleep and you do that whole thing several times throughout the night. And the amount of Rem sleep that you have changes throughout the night and the amount of slow wave sleep you have changes throughout the night, such you have more rem, sleep usually later on. And that whole thing is called sleep architecture. And if you preserve the quality of that, then you can get much sleep but still feel as rested. Now, there are two drives that push us to sleep. One is this idea of homeosasis that we've talked about before. That we need sleep to survive. You can't exactly explain why. Don't fully understand it. It's kind of crazy. After all these years, they can't fully explain why we need to sleep. We just know that you do and if you don't, bad things happen. But part of our drive to sleep is driven by physiological need. Just sort of like part of your need to eat food is driven by like, well, how long has it been since you last ate food like That's just a linear process. The longer time goes on, the more you need to do it. But there's also this other aspect that is cyclical that's caused by your brain's internal clock called your circadian rhythms. And I'm going to put this in context of food because it's a little bit easier to understand now. Obviously, the longer it has been since you last ate, the more your body needs food, right? But have you ever experienced that you were super starving for lunch and then something happened or something came up and you're running around or whatever and all of a sudden it's, you know, almost dinner time and you're like, oh, I'm not as hungry anymore So like, yes. One process driving your hunger was how long has it been since it's last slept? Since you last slept? Another process driving your feeling of hunger is, is it lunchtime? That is being controlled by your internal clock and that's going to make you feel hungry sometimes whether you ate recently or not. And if it's not lunchtime, then you feel less hungry. But both of those are contributing to how hungry you feel. Just like with sleep, both of these processes are contributing to how sleepy you feel. So this is one of the problems with naps. If you take a nap at say, 06:00 P.M. then by the time it gets to be midnight, your brain \*\*\*\*, your circadian rhythms are like, hey, it's about time to go to sleep. But because you just slept recently, it's like you just had a snack before dinner. Your brain is like, oh, but I'm not hungry for sleep. So then you stay up super late. And then it causes disruptions and you mess up the quality of your sleep because you get the best quality sleep when your circadian rhythms are in sync with your day and your other behavior and your sleep wake cycle. Just wanted to take a moment to talk about Circadian rhythms. These are daily fluctuations caused by your brain of various hormones and neurotransmitters, and physiological aspects like your body temperature, things like melatonin. Your brain produces around 30 minutes before it thinks you want to go to sleep. If you fall asleep at that time, that sleep is more restful than if you fell asleep at some other time in the morning. Your brain produces a lot of cortisol, the stress hormone, to get you out of bed and ready to face your day. And if those processes are disregulated in some way, well, then you're not going to get really quality sleep or you're not going to feel like waking up in the morning. And we often don't take advantage of them in the ways that we can. One of the really interesting things about these processes are controlled by the hypothalmus and they are reset by light your brain evolved in. The principle is like, oh, and there's a lot of ambient light out, that must mean it's daytime. That's how you know when to start releasing cortisol, when to stop releasing melatonin, and when it's dark, oh, maybe I should start releasing melatonin soon. It's problematic when we have lots of artificial light or if you're inside a lot of times. Interestingly, the light that your brain is most tuned to is the specific color, blue of the sky. You have receptors in your eyes that don't actually help you see. They just say is there blue light around? And they send that information to the hypothalamus to decide, oh, when should I set my clock for the day or not? And sleep hygiene is just this overall term for like, what are the different things you can do that will help you fall asleep faster and stay asleep better. And improve the quality of your sleep so you're more rested and alert throughout the day. We'll revisit some of these at the end if we have time. But basically they are relying on some of the things that we talked about, that if you go to bed at the same time and wake up around the same time every day, then your brain knows, oh, this is when I release Melton, this when I release cortisol. And it makes it easier to get more quality sleep. But because oftentimes you're like, oh, I didn't sleep well last night, I got to take a nap. Well then you're messing up your circadian rhythms. You're messing up your sleep lake cycle. Or you're like, oh, I'm gonna sleep in super late. Well, that might be helpful to make up for sleep, but now you don't go outside until it's 11:00 A.M. So your circadian rhythms doesn't start till sort of later and now it's not going to release melatonin until later or you have bright lights on all night because you're trying to steady. And now you've really messed up your sleep. So tomorrow when you're like, oh, I'm gonna go to sleep early, you can't because your brain is not ready for it. Or even if you could fall asleep because you're so sleep deprived, you might be able to, but your brain hasn't released melatonin yet, and so you're not getting the most out of that sleep. And alcohol messes it all up as well because alcohol can make it sometimes easier to fall asleep. But it doesn't make it easier to stay asleep and it also disrupts your sleep architecture and exercise, by the way, can improve all of that. I'm going to take a few minutes talking about some of the effects that sleep, um, has on our behavior in our brains. Yes, yeah, okay, so the question is the way that light affects our brains when before we go to sleep, wearing sunglasses inside help. Yes, the key things are that you want to get lots of bright light early in the morning, so your brain's like, oh, time to start the clock. You also want to not get lots of bright, particularly ambient overhead lights, particularly blue lights. So some people, I've had athletes here like, oh yeah, my coach makes us wear these like orange glasses because that blocks some of the blue light so it's not disrupting your melatonin release. So one suggestion is you could just block all light with sunglasses or you could just, you know, turn off all of the overhead lights or one of the benefits of like, we'll just close your eyes and go to sleep because then that will also help. So there are many factors. Um, uh, that impact it because if you stay up really late and you're wearing sunglasses, like, oh yeah, it's better that you're wearing sunglasses, but it would have been better to just have your eyes closed and be asleep and then you wouldn't be getting as much light. Does that answer your question? Sorry. Does that answer your question? Oh, sorry. I was looking at the wrong person. So yeah, sleep helps with a whole bunch of different aspects. It improves our mood. It reduces pain and stress. So you could have the same, you know, stimulus, but it just isn't as painful. It can reduce our rewarding response to unhealthy behavior so that they don't release as much dopamine and we don't get impulsively pulled towards them as much. It can even improve our immune function as well as our ability to focus and pay attention. And one of the reasons that happens is we can see from this Pet image, which is a positron emission tomography, that's just looking at how much glucose or sugar your brain is using. Well, if you don't get sleep for 24 hours, well, a whole bunch of re, brain regions kind of shut down. But primarily pretty much all of the prefrontal cortex. And so it becomes harder to utilize the prefrontal cortex. There's this also interesting reciprocal relationship between sleep and stress. Whereas, if you get enough sleep, it reduces how reactive your stress response is. But if you're chronically stressed, or even temporarily stressed before you're trying to go to sleep, then it disrupts sleep. So it's either an upward spiral where sleep helps reduce stress and it becomes easier to fall asleep. Or as a downward spiral where you're stressed and that disrupts your sleep and therefore you're more stressed because you haven't slept as well. This study here, they looked at people with insomnia and measured their cortisol levels over the course of the day. Now, everyone's cortisol levels go up in the morning and they should go down at night. But what they noticed is that in the people with insomnia, their cortisol levels had this little bump right before bedtime. And one explanation of that is like, yeah, because they're so anxious about not being able to get enough sleep that they're causing more cortisol. Another explanation is, yeah, that's why they have insomnia because their cortisol levels are naturally going up and that is causing their insomnia. My interpretation of it is, well, it's probably some amount of both. That yes, the more anxious you are about sleep, the more you're going to increase your cortisol and therefore become a self fulfilling prophecy. But also some people probably have, I mean, some people do have different daily circadian rhythms. And also some people don't inhibit their cortisol as much before sleep, and those people are more likely to have insomnia. Sleep also is crucial in utilizing the proper function of the limbic system. One of the things that happens during sleep is something called memory consolidation, where the things that you experienced and learned throughout the day actually get cemented into your long term memory. During slow wave sleep, the prefrontal cortex talks to the hippocampus and it is like, hey, this, we should remember this for later and like, okay, the hippocampus, okay. And records all of that. If you're spending all this time going to class and then not sleeping well at all, well then it's like, you know, filling up your gas tank while you have a hole in the in the gas tank that it's like, yeah, it's better to do it but like, well, if you plug the hole then you would retain more of what you're being talked. Sleep also reduces a Migdla reactivity. So the Migdla reacts to emotional information. It's looking for threats. If you have enough quality sleep for your brain, well then just turns down the volume on the amide and then make you a little less reactive. And that for some people, might be the answer to all their problems. For example, there's a study on depression where they said, okay, let's not focus on all of the depressive thoughts and all this other stuff, that you clearly is a problem. Let's just focus on fixing your sleep and getting a good night's sleep. And what are the things that you can do to have good sleep hygiene and, you know, change your thoughts around sleep. And that was just as effective at treating their depression as other forms of cognitive behavioral therapy because sometimes all you need to do is just turn down the volume of the Igd a little bit so it's not throwing everything out of whack. Then there's also, as I mentioned, this relationship between sleep and pain. And similar to stress, more quality sleep reduces your brain's reactiveness, reactivity to pain. But also, unfortunately, when you're in a lot of pain, it makes it really hard to fall asleep. And so one of the things that happens in things like chronic pain is like you're in a lot of pain and so it's hard to sleep and someone's like, hey, you know, you should do sleep really well and you're like, yeah, a hole. Like if I could I would. But that's when it becomes this sort of downward spiral of a self fulfilling prophecy, where pain disrupts sleep disrupted sleep increases pain, and so on. And this graph illustrates one study where, where they wanted to look at, is it just the amount of sleep that you're getting? Or is, is it the quality of that sleep? So I mentioned that before, but this is some evidence for that. So in this particular study, they either gave people 8 hours to sleep or 6 hours to sleep, but they gave them 6 hours in one of two ways. Either they said, okay, well you know, the eight hour people. They're gonna go to bed at 10:00 P.M. and sleep till 06:00 P.M. The six hour people, well, you're gonna go to bed at midnight and sleep until 06:00 A.M. So they got 6 hours, but it was all at one time. That's the restricted sleep onset, I believe is RSO. The other group, they said you're gonna get 6 hours, you're gonna go to sleep at ten, just like the other people. But every couple hours we're going to wake you up for like 15 minutes and then let you go back to sleep. So you get the same total amount of sleep, it's just not at one time. And what they found is that the people with the fractional sleep that had disrupted sleep, they had a lot more physical discomfort and aches and pains. So they're still getting the same overall amount of sleep. But just the quality of that sleep wasn't as good because they had disrupted sleep architecture. So if you don't have more time to sleep, okay, pick 6 hours and just go to sleep at the same time, wake up at the same time. Be consistent, night to night. And that is much better for you than trying to sleep 8 hours some nights and 3 hours or another night at a totally different times, or even 8 hours every night. But just sometimes you go to bed at nine, sometimes you go to bed at 03:00 A.M. because the sleep quality matters. The pain or the pain reducing properties of sleep that we see are likely mediated by endorphins. That when you get enough quality sleep, it allows your brain to produce its own form of morphine. One of the interesting things from this graph, as you see, like over the few nights of restricted sleep, you know the disrupted sleep group, they get worse and worse and there are more and more pain and discomfort. What happens on this last night here is they keep everybody up for 24 hours, so they're pulling in all nighter. So one thing that you'll see is like, okay, well if you've only been getting 6 hours of sleep, it's not quite enough, but you can kind of get by. But if all of a sudden you have an all nighter, well then you're just as bad as if you've been getting fractional sleep the whole time. The other interesting thing about this is like if you look at the group that's been consistently getting 8 hours of sleep. Well, if they have to pull an all nighter, it doesn't really impact them much at all, like it goes up a little bit the next day. But if you're consistently getting enough quality sleep, then even huge fluctuations and having to stay up all night won't affect you as much. It's just that we're often focused on those little fluctuations I have to get sleep tonight. And we're not focused on our bigger picture of the things we can do. And in fact, many of the issues of sleep hygiene have nothing to do with how much sleep you're getting or, um, anything to do with bedtime. They're like, Did you exercise today? Did you get sunlight in the morning? Did you stop drinking caffeine, you know, and so oftentimes we're like, right now I need to fall asleep. Right now it's like, well, you can't always control that. But going forward you're like, oh, well I can plan ahead a little bit better. So we just have a couple more slides to get through. This one is sort of hard to understand, but I mean, it's sort of hard to see. This is an FMRI study looking at statistical subtle blood flow changes where they found that insomnia reduces prefrontal activation. We're doing this variety of tests, so if you're have insomnia, it disrupts your proper prefrontal cortex function. But if you adequately treat that insomnia, not just like, oh, get one good night of sleep, but like treat it for like six weeks of cognitive behavioral therapy and interventions to treat this insomnia, then it's sort of hard to see. But like, oh, the same region like this is showing, these are the regions that are deficient insomnia. And if you treat the insomnia well, then you see improved activity in those regions. Yes, insomnia causes prefrontal deficits, but you adequately treat it. You can restore them. Now, one of the questions that sometimes people have about sleep is something that seems so intuitively obvious, but it has actually been very difficult to explain. When you wake up, you just feel really rested and restored. We can't exactly say for a long time is that sleep gets rid of this feeling of sleepiness. But great evidence for we can observe that, but we don't know why that takes science. One of the things that scientists are known for a long time is that the more you're alive and awake and living your brain and body produce metabolic breakdown products. These extra chemical junk that accumulate throughout the day in the rest of your body. That stuff is dealt with something called the lymph system, where it just takes it away and it gets processed by the liver and gotten rid of. In the brain, there is no lymph system, there's not enough space for it. So they always wonder, well, how does the brain deal with all this extra junk? What they found is that when you fall asleep, little channels open up around all of the blood vessels in your brain and allow the fluid in your brain, cerebral spinal fluid, to flow through and wash away all this accumulated metabolic junk that when it's there, it's just sort of getting in the way of the proper functioning of everything else that's supposed to happen and it washes away. So when you feel clear headed in the morning, not just a metaphor, like it literally has washed away all this stuff. And if you don't get adequate sleep, then it can't clear away all this stuff and it starts getting in the way. I'll just put this slide up here again, as a reminder of the sleep hygiene. I'm happy to answer. These are sort of more, I've talked about the theoretical aspects of this. Do you have any practical questions for how you can apply them to your life? I'm happy to answer them or come to office hours, but yeah, just do all this and get all those benefits. Thank you.

# Week 3 lecture 1

Okay, so we are going to continue talking about stress because it's continually relevant in your life. Yes. Just to remind you of some of the goals of this class that yes, we want you to learn and understand the neuroscience of stress, but we also want you to apply it to your lives so that you don't need to be unnecessarily stressed or recognize when stress is getting in your way, or even how to use stress to your advantage. A lot of times in our culture or in our day to day lives, we think of stress as this bad thing. There are tons of videos online and books like How to beat stress and how to overcome stress, and how to calm down. And you know, if you have anxiety it's like, oh, I just need to reduce my stress. And we're always thinking we need to get rid of stress. But that brings up an important point of like we do, we have so much stress. If it's bad for us, why did it evolve? Why did our brains evolve this way? If it's so bad for us, um, is stress always bad for you? Is bad for you? The answer to that question is complicated in that, no, it's not bad for you, but yes, it is also sometimes bad for you. How can both of those things be true? Well, I'm going to connect it to this concept of homeostasis that we talked about before. Where to continue living. You have to exist in this narrow band of conditions too much and die. Too little is bad and you die. Temperature right, like the temperature in Los Angeles is great. But if the temperature got a little bit too hot for too long and your body temperature got too hot for too long, then you would die. If your body temperature got too low for too long, then you would die. So, is heat bad? Well, it depends how hot you are right now, it's like, you know, asking, is water good for you? Yes, water is essential to life, and yet, if you drink too much water too fast, then you can dilute the appropriate concentrations of key nutrients in your body. And you get something called hypoeutremia and you can die. Or, you know, if you just drink a little bit, you know, trying to drink water but it goes into your lungs, well, it's a tiny bit of water, really bad and you die. Is oxygen important? Yes, oxygen is essential. Can't breathe pure oxygen. You would die. Too little oxygen, you would die. I think you get the picture. Homeostasis is all about finding the right balance. And stress is a crucial part of homeostasis. So it's essential to our survival. Our brains evolved stress to help us survive, to help us avoid danger, or if we are in danger, to better react and respond to that danger, to say, okay, maybe I shouldn't worry about digesting this meal that I just ate. Because if I got eaten by this lion right now, it doesn't matter. So boom, let me activate the stress response and that's super helpful and it can enhance your performance in the moment as you're running and all the blood flow is go into your legs and your heart is pumping and your adrenaline's flowing and, uh, you're not okay. You know, building up your immune system or repairing damaged tissue for later because you're like, well, I need to use my resources. Now, stress is also really important for a lot of positive emotions, like excitement and surprise. When we are excited about things, that's an activation of the stress response. And sometimes when we view stress, it's like, oh, stress is always bad and you get rid of stress, then we wonder, well, where did all my emotions go? Why aren't I excited? About things? Why aren't I motivated about things? Well, it's because you tried to eliminate all of your stress. But stress is sometimes bad, particularly when it is prolonged and out of our control. It can cause mental health and physical health problems like it can exacerbate clearly. It can cause mental health challenges and burn out and leading to depression or anxiety. But it can also cause physical health problems like chronic pain. Or even exacerbate conditions like acid reflux or diabetes or epilepsy. Like a wide range of things are all affected, potentially negatively by stress. And it can impede your performance, right? Like if you're an athlete, you've probably experienced that situation where you're like too nervous, that you're out of the zone, you can't really focus. Or if you're too nervous for an exam or if you're too nervous to ask someone out on a date, like these things can totally disrupt your goals and ultimately it can ruin your happiness and well being. Uh, so to understand how that can be the case, I want to share this research something called the Kis Dodson rule or law. I mean it's Yuki's Dodson theory sometimes when theories have been around for a long time and then we call them laws or rules, whatever, like it's just a theory that explains a lot of data and makes predictions about future data. And these two researchers.com predictive analytics can help your organization forecast in the future. I don't know. Siri was apparently listening in to lecture series not enrolled at UCI, so we'll have to charge her tuition for that. Yeah, so they noticed like, huh, there seems to be, sometimes stress is really helpful and sometimes it's not helpful. How can we explain when it seems to be helpful and when it seems to be not helpful and so on? And what they found is that for complex tasks, tasks that require thinking or complex behavior, there's something that's called an inverted U shaped function of optimal performance. Which is a complex way of saying there's this curve, it's an inverted U shape, it is like shaped like a U, but you know it's upside down because it starts out low and then it goes up and then it goes down, it's just a curve. And you can think of this as like the goi locks rule, like go locks tasted the porridge of the three bears. Just like, oh, this one is too hot. Oh, this one is too cold. Oh, this one is just right. And it turns out, when it comes to our stress response, if you have too little stress given the challenge of the situation that you are facing, well then you're not mobilizing enough resources to deal with it and you're not achieving optimal performance. In fact, as you get more stressed, your performance increases. I like to put this in terms of sports a lot of times because it makes it a little more concrete. Like if you're an athlete and you go to practice every day, well sometimes you're not performing at your best because practice is boring. You have to do it all the time. Or if you're studying, you're not always at your peak performance because it's boring and you're doing it for 8 hours on a Saturday when you want to be doing something else. And so you're not actually as focused and performing as well as you could. And if you got a little bit more excited, like if your friends was like, hey, just study as hard as you can for like an hour 'cause we're gonna go out to a party. We're like, okay, great, I'm gonna really focus and get down. And you stress yourself out a little bit more to where you're actually fully focused on what you're doing. And this is why in terms of athletics can feel easier to perform at your best when you're playing another team. I'm like, okay, oh, how this matters. Like the outcome of this matters in a way that makes it easier to focus and easier to perform your best because you've reached the sort of optimal level of stress. But if that stress continues to increase, then your performance starts to go down because now you're like, oh my god, you start thinking about the negative consequences. Like you're studying for an exam. And the exam is happening and like, I don't know if I can study, I have to go to sleep. I, I can't accomplish all of these things. And now you stress yourself out even more, and now you're getting in the way of your ability to study. You're an athlete. Who's now, all of a sudden you're in the championships and you're stepping up to the free throw line. You're like, okay, now there's 50,000 people in this arena watching and people are watching around the country. And if I missed this free throw, everyone's going to be so upset and I'm gonna be so upset myself. And if you could just go back to your driveway where you're just oh, excited. Let me see how many free throws I can make in a row. Oh, it would be so much easier, but now you're focused on all the negative consequences. You're stressing yourself out unnecessarily, and it's getting in the way. So in some cases, stressing yourself out more improved performance, and in other cases, stressing yourself out more decreases performance. And that's why it's crucially important to know where are you at in terms of your stress response. And most of us fall into the unhelpful thinking that like, oh, I always need to reduce my stress response. And it's often very helpful. And so our straight I'm like, oh great, yeah, keep doing that but we don't, we're disconnected from like, who would it be helpful in this moment to reduce my stress response or would it be helpful to actually increase my stress? So putting this in terms of athletics, again, sometimes what an athlete needs to do is learn how to treat that free throw, just like they were in their driveway by themselves shooting a free throw. Because what's actually the difference between those two? Nothing. You still bend your knees the same way you still bounce the ball, the same way you still shoot your arm the same way. Like nothing is actually different about those two situations. It just feels different because of the stress. So it's sometimes helpful to treat these like big championship games as if it's just practice and it doesn't matter at all. But it's easier to do that when you are in your driveway and you're free throws to try and treat that like it's a game and it's the most important thing in the world. And then we have consistent practice and the ability to consistently be in that peak zone in the performance. But oftentimes we don't like stressing ourselves out, so we don't ever do it until we're forced to, until something else stresses us out and then we haven't practiced the ability to be resilient against that stress. This is very much related, by the way, to what is happening in your brain and in your prefrontal cortex particularly. Researchers found that two of these neurotransmitter systems, neuropenepherine and dopamine, We've talked about serotonin as well, but here we're just focusing on these two. They're crucially important in the proper functioning of the prefrontal cortex. And when the concentration of these is too low, well, your prefrontal cortex doesn't do a good job of overriding your impulses or thinking through things strategically or setting long term goals. You're kind of in a state of inattention, or drowsy, or lazy, or whatever. As stress increases, then it increases the concentration of these neurotransmitters. And you can actually utilize the full function of your prefrontal cortex to focus and make decisions quickly and override impulses that aren't helpful and so on. But as stress increases, those neurotransmitters keep increasing and then they start disrupting proper functioning of the prefrontal cortex. This is why things like norpeneprin and dopamine aren't good in the sense that more of them is not always better. Yeah, you need them, but sometimes too much can disrupt the proper functioning of the prefrontal cortex, in which case your habits and impulses take over. Now, if you've trained your habits to do exactly what you need to do in times of stress, then great, you probably don't have a problem. The issue is that many of us don't fully train our actions and our nervous system how to appropriately respond when we're super stressed. And that's why when we're super stressed, everything falls apart. I just wanted to share two studies that kind of illustrate this on a more practical level. In this particular study, they took college students, I believe, and gave them an exam. And they asked them before they took the exam how much anxiety they had about the exam. One thing you can notice about this data. These data? It's plural, but I was called singular. Each of those points represents a person like you or you. Before you took the test, had a certain amount of anxiety and then you got a specific score, right? So each of these is an individual person. Those are just facts, those are just observations that anyone could make. But as I mentioned last time, science is about trying to understand why are those facts the way they are? Why those measurements the way that they are. One way of looking at this noisy data, because almost all data, when it comes to people, is noisy, Is to say a well, it of looks like the people who had higher anxiety did worse on this exam. That's one story of describing what is happening here. That's a linear relationship. Meaning if you have low anxiety, you do well. And if you have high anxiety, you do poorly. And that's what that line, that straight line is showing. That does a reasonable job of explaining all of this variability and what's happening in the students. Yeah. In general, the students who have less anxiety do better. And the students who have more anxiety do worse. But when we apply the Syracuse Dodson Theory, that is a better explanation of what is happening because this curved line starts out low, goes up, comes down. That does a better job, a significantly better job of explaining what is happening with all of the students. Because this predicts that like yeah, students who have less anxiety do better than students with a ton of anxiety. But the students who do the best are the ones in the middle here. I mean, it was only, you know, maybe a five percentage point difference. But students who do the best are the ones with like a moderate, slight to moderate amount of anxiety. And that is what that curve represents. That too little anxiety about the test probably means like this is an explanation of why this should be the case. Because too little anxiety about the test probably means, well, you didn't study enough. Because you're like, oh, this is gonna be easy. So you just didn't study. And then when you got to the test, you'd be like, oh, this is so easy that you weren't focused and you made stupid mistakes. And if you just had a little bit more anxiety about the test, you would have been okay, I really need to study for this. And then when you were taking the test, you'd be like, okay, I really need to focus. And you had really recruited all of your attentional resources to devote to taking this test instead of, huh? I wonder what I'm going to have for lunch later. Oh, I wonder what I'm going to do this weekend, like the stress would help you focus on taking the test. But yes, as that stress increases, then the whole time you were studying, it would be distracting you from just studying 'cause you're like, oh my God, what if I study and I fail? Or while you're taking the tests and you don't get the right, you know, you don't know the right answer to the very first question. Then you started all this catastrophic thinking like, oh my God, what if I can't get all of the rest of them and that gets in your way. This also, uh, works in physical performance, as I mentioned, athletics. But I really like this study because it shows the relationship really nicely. In this particular study, they took swimmers because swimming it's, you know, an individual event. And you do the same exact thing over and over again. And so they could ask them over and over again like, well, how much anxiety are you experiencing? How fast did they swim that race relative to how fast they normally swim that race? Was it faster or slower, I should note, did measure two different kinds of anxiety. One is what's called psychic anxiety, where you're thinking about all of the terrible things that could go wrong. That kind of anxiety wasn't helpful. But what's shown here is what's called somatic anxiety. Which is basically what the activation of the stress response does, the feelings of anxiety, your arms being shaky, your chest pounding, your tightness in your breathing, your butterflies in your stomach. These are all activations of the sympathetic nervous system. And then they sort of standardize it for every individual because every individual has different average levels of anxiety and different average levels of speed. And they said, okay for you, if you're experiencing the average level of anxiety for you before this race, how well do you do in terms of time relative to how you normally do? What they found is when people had too low of an activation of their stress response, well then they generally swam slower. And as they got a little bit more excited for the race, then they reached this optimal zone of stress and performance. But then Maybe for some of them who had, you know, weak mental resilience or for whatever reason, when they got too stressed, that also disrupted their performance and they swam slower. And so it's really about understanding your own stress response and where you are right now so that you can know when do I need to stress myself out a little bit more and when do I need to calm myself down? Because this is all just description, descriptive observational of okay, this is what happened. Um, what I am then taking another step is saying like, oh, and if you know this is happening, then you could do something about it. Well, we can't know from these studies because these are observational. I'm suggesting an experiment, but you could try that to see and either do your own experiment, or we can rely on other experiments that are experimental. Just show that like, oh right, if you are super stressed out, it is really helpful to calm down. Or sometimes when you're not stressed out at all, it's helpful to remind yourself of why you're motivated or excited. This is really important because if we get disconnected, our awareness of our own stress, then we can just let it keep running rampant and not even be aware of it when stress and our stress response is chronically elevated or cortiscel levels are chronically elevated because we keep activating the stress response over and over again, then it can lead to a lot of negative outcomes. This activation is not the same thing as lots of short activations, like it's acute stress is something where there's a stressor and then we respond to it and then we're not stressed anymore. Right? Like oh, I was hungry and so my blood sugar was dropping or my blood sugar was dropping there. I was hungry. And then I ate something. So I was stress, the stressor activated the stress response and then I dealt with it and I'm not stressed anymore. So that happens every single day. That is not chronic stress. It happens a lot. It happens repeatedly. But the stress happens, you appropriately deal with it. The stress has gone. Chronic stress is where the stress isn't appropriately dealt with and it sort of keeps hanging over you all the time. Like you're chronically in the back of your mind just thinking about all the terrible things that could go wrong with your life. So sometimes it could be anxiety as a source of chronic stress. Sometimes the chronic stress is, you know, you're experiencing poverty or bullying or racism. There are many sources of chronic stress that we can't fully deal with. They just kind of are constantly there and stressing us out and this can lead to unfortunate problems. And like that sucks particularly for things that are outside of your control. But it's helpful to understand that nonetheless, like if the source of your chronic stress is not having enough money, or if the source of your chronic stress is, you know, being in an abusive relationship, for example. Like just knowing that doesn't solve the problem. But it can help you realize, oh, I'm in this chronically stressed state, I should focus more on how to calm myself down. Also, you can sometimes when we're chronically stressed, well, we're chronically activating the same habits. And we don't even realize how we're making certain choices that are keeping us in that same state. And we can have more of a commitment to like, oh, I could do something about this even though your emotional circuitry would, no, no, don't do something about it, because maybe something worse could happen. But it's crucially important to understand when we are experiencing chronic stress, either because we can't do something about it and therefore, oh, just treat yourself with more compassion or find other workarounds, or because sometimes we think we can't do something about it. But in fact, it's just extremely stressful and scary to do something about it. In which case, oh, well, I should find support in how to actually address it. All of these aspects, by the way, are kind of related to the fact that we cortisol, which is released in the stress response, is really beneficial for short term stress. But when it's chronically elevated, it causes problems. It damages brain circuits like cortisol releases sugar into your bloodstream. It's really helpful when you're trying to run away from a lion, and your muscles need sugar. It's unhelpful when you live in a society as ours, where there's abundant food and abundant sugar and lots of chronic stress. Well then it can increase risk of diabetes, it can cause immune problems, it certainly can cause gastrointestinal problems. And all these are related to, yes, this is what the stress response is supposed to do. It's just right. It's only supposed to be temporary and brief. It's not supposed to be chronic. M now last week we talked about some of the physical things that you can do with your body to reduce stress, like sleep and exercise or slow breathing. Exercise, by the way, is kind of interesting because exercise is actually a stress. It stresses you out, but it's an intentional that you just do for a short period of time and then it actually reduces your stress in the long term, sort of how stress is good for your heart. It's kind of weird, right? Like when you exercise, makes your heart pound, makes your heart work harder. Why is that good for you? Ah, because it strengthens your heart and means the rest of the time, the 98% of the time, when you're not exercising, oh, your heart is more relaxed. So exercise is a stressor. But stress, as I said, isn't bad. It can be healthy. It's just, oh, sometimes acute stressors can actually help us deal better with a chronic stress. But this week we're going to be focusing on psychological factors that influence our stress response and influence the limbic system. So instead of just the things that you are doing, we're going to be focus on, oh, the things that you are thinking about or the things that you are focusing on. There are three main ones that we're going to talk about. Really. I don't know if that all comes down to this. Basically there what I call them of controllability, certainty and consequences. So I call them the three. C is just sort of easier to remember in category, right? There's three things to start with, controllability, certainty, and consequences. When things are generally out of our control and we keep trying to control them, then it increases stress, right? Like it's more stressful to try to, you know, throw a ping pong ball into a red solo cup that's 15 feet away. That's a little bit more stressful than if there was a solo cup right here that you just put a ping pong ball into, right? That's why it's a game that people play because it's more stressful and it's more exciting. It would be boring like, hey, can you pick up this ping pong ball and put in this cup here? Yes, of course I can do that. There's no doubt I have 100% control over it. It's not exciting at all. So the lack of control increases stress. Sometimes that increases stress pushes it into the optimal zone where it's exciting, sometimes that increases stress pushes it past that optimal zone where it's no longer exciting. And it is anxiety inducing like oh, you're having to take this free throw, You could potentially lose the game and everyone you love will hate you and you'll miss out on, you know, making money for the rest of your life or whatever. Like oh, well then putting this ball through this hole like oh, it's suddenly not as exciting, it's anxiety producing. But it would be much easier to do if it was simpler and you had better control over it. And all of these things actually I think make really good intuitive sense when we talk about things like gambling, which is why I put up this roulette wheel. Gambling is excited specifically because you don't have full control over it. If someone paid you say $20 an hour to stack boxes, I'm okay, I can do that. I'm fully confident. I can take a box and put it here. And take a box and put it here. And you could do that. And that's a job when when it is more stressful. However, if there were things that got in your way to control that, like, you know, people, there were obstacles or people kept interrupting you or people kept taking the boxes and putting them back where they belong. Like the lack of control would stress you out. Sometimes that can be in a good way, sometimes that can be in a bad way. This is also related to certainty, your ability to predict what is going to happen. So this relates to gambling. If you knew exactly what you needed to do, even if it was difficult, but you had 100% certainty that you could do it. Well, that's like a job. When there is some uncertainty involved, then it becomes more of a risk and it turns more into gambling. Like if I said hey, you know, stack all these boxes instead, like, you know, open boxes, I could pay you $20 an hour to open boxes. Okay. Sure. Or I could say, hey, open all these boxes in one of them, there might be $120 bill. Well, you might not do that because you're like, it's not worth the risk. But any given box, it would make it more exciting to open because there might be $120 bill in there. Because the certainty of what has happened and the controllability has changed. So roulette is exciting because you don't have full control over where the ball lands, right? If they could say, hey, put this ball on the number, you go okay, well, that's not gambling and that's why no one would pay you money if you're able to do that. But if you say, oh guess where the ball is, Lands, well, you have some control in that you can choose red or black or which number to choose, but you don't have certainty as to how it will end up. But all three of these factors actually interact. Because if you've ever gone to a casino, or have you ever watched someone play roulette, who you don't know, It's extremely boring because it's just Okay. The ball rolls around the wheel and it lands on, you know, red 14. Okay, that's cool and rolls again. Oh, black, 28. Like who cares? Nothing can be more boring in the world than just the ball landing on numbers. Why is it extremely boring? Well, you don't have any control over where the ball lands. You don't have any certainty about where the ball lands, right? And here I am just saying that both of these factors increase stress. Ah, only increase stress as it relates to consequences. If there are no consequences and you're just sitting there watching it, then who cares? You could have no control over something. But if it doesn't matter, you don't have control over what color car drives past you next, you have no control or ability to predict that. But who cares, literally, who cares has no effect whatsoever on your life. But as soon as you make a bet, as soon as you say like, hey, I'm going to put $10 on black. Ah, now it matters whether it lands on red or black, because you either win money or you lose money. And so controllability, certainty only really come into play in so far as there are consequences, either positive consequences or negative consequences. And if we have consequences and we hold that stable, like there's, you know, $10 win or lose, and then you reduce your ability to control things, or you increase the uncertainty. Well then it makes it more stressful. Or if you have the same level of controllability uncertainty, but then you increase the consequences, then you make it more stressful, like you're betting $1,000 Now that's more stressful. Whether that's exciting, stressful, or anxiety inducing. Stressful depends on what the potential consequences are or where you're at already in terms of your emotional state. So when you're thinking about these three variables, decreased control and decreased certainty leads to increased stress. Whereas increased consequences lead to increased stress. So could, if we were talking about these things in terms of what are the things that increase stress, I could have said uncontrollability and uncertainty and consequences, but I just thought, okay, well that's harder to remember. Certainty, controllability, certainty and consequences. And it's easier to remember the direction of how they control stress because that's much more intuitive. I just wanted to point that out. Yes, these are the factors that affect stress, but the direction in which they do it might be different. I wanted to share some studies that illustrate this in this particular study. Does anyone have any questions about that? By the way, is that clear, uncertain about how that will work? Because like uncertainty when 0 presser is telling you something, you're not really certain but you're pretty sure it's going to be on the exam. Well, that creates stress. Hopefully a good amount of stress for, oh, it's exciting. Interesting. But if you're like, oh, I'm pretty sure it's gonna asking about that and I have no idea what the heck he's talking about then now it would be a great time to raise your hand or ask a question. And I understand. That's a lot to ask because if you raise your hand when I just framed it that way, people are like, oh, now I have to show I'm stupid and everyone else understands this, but you're not. This is why I really want to emphasize that science is about curiosity and understanding. So even if you fully understand it. You're just curious about some of these applications that are questioning or skeptical of some of the things I've said. You can feel free to raise your hand or ask questions. You don't even do it right now, but feel free as we continue talking about it. So in this particular study, the patients with panic disorders, they had high levels of anxiety. They had them breathe through a mask where they pumped in higher levels of carbon dioxide, regardless of whether you have panic disorder or not, If you're suddenly forced to breathe air that has higher carbon dioxide and therefore less oxygen, it is stressful. You can try this yourself by like, you know, covering your mouth or not giving yourself the ability to breathe enough oxygen. It is elevating of your stress response. It's just that in people with panic disorder, if you do this, they're much more sensitive. It can sometimes trigger a panic attack or at the very least, increases your anxiety even more. So we all are sensitive to this, it's just some people are more sensitive if you already have a lot of anxiety. And they said, okay, just try and deal with this for a few minutes. At some point, we might turn on this light bulb that'll let you know, you can adjust the dial for the carbon dioxide and even when the light comes on, try to just, you know, breathe through it. The experiment won't last that long, but if you really, if you really can't deal with it once light bulb was on, then you can turn down the carbon dioxide a little bit to a point where it's tolerable. And then for half of the people, they just didn't turn on the light bulb. That half of the group was like when the light bulb is going to come on. It's really uncomfortable. I'd love to be able to turn down this carbon dioxide right now, but they're not giving the signal that I can. But before that happened, they turned it on for half the people at like 5 minutes before that happened, there wasn't a difference between the two groups, right? Because it was the first 5 minutes, they were both sitting there uncomfortable waiting for the light bulb to turn on. And both groups had a moderate level of anxiety. They were at like a three on average for the first 5 minutes. Then for some of the people, the light bulb went on and they could fiddle with that \*\*\*\*, and some people it didn't. Well, the people who didn't come on, they were like, this is really difficult to breathe here. It would be nice to be able to adjust it, but they weren't able to. And their anxieties went up and up and up because they didn't have any control whatsoever. Situation, they couldn't turn down the \*\*\*\*. But they also knew that if things got worse, then they wouldn't be able to turn down the \*\*\*\* potentially later on. So even if you're like, yeah, things are pretty good now, but what if in 30 seconds I can't deal with it anymore? Oh, I hope that the light bulb comes on and it increases more uncertainty and lack of control. And so their anxiety levels keep going up. In the other group, however, their anxiety stayed pretty steady or even like went down a little bit because they knew it was like okay. I know it's really difficult, but if at any point I can't take it anymore, I can just reach out and fiddle with that \*\*\*\* now and turn down the carbon dioxide. Now, one criticism you might have of this study. Does anyone have a criticism that they have a study? The stupid study? Yeah. What did you say? Oh, yeah. So they could do that, they probably would have been eliminated from the study. They say, oh, that's the data point you did where you weren't. So that's one possibility. Anyone see another problem? Like if your light is on, is there a problem with turning down the \*\*\*\*? As I've explained the story so far, we, yeah, the less stress, right? One interpretation of this, she said, if you turn down the \*\*\*\*, they're less stress. Because one interpretation of this is like, yeah, no \*\*\*\* buddy. Like of course they're less anxious. Like they just all turned down the \*\*\*\* and they have less carbon dioxide. So like this is a dumb study, but we don't know from this data is like, wow, what percentage of them turned down the \*\*\*\* and what percentage of them just were like, oh, I'm going to power through? And that will be a very reasonable critique of this. Study because it's like, well, that seems an important piece of data except for one crucial fact, the \*\*\*\* didn't actually do anything. It didn't matter whether they reached out and fiddled with the \*\*\*\* or just told themselves that they could fiddle with the \*\*\*\*. Because whether or not they did it, everyone the entire time was breathing the exact same level of carbon dioxide. And this is in fact why it's labeled illusion of control. If you're perceptive of that, they all had the exact same level of control of the situation, which is to say none but the group that was allowed to fiddle with the \*\*\*\*, they believed that they had control over the situation. This is what like a placebo is. Oh, I believe, oh, this is, oh, it's got to do something and you act like whether that you took action because you fiddled with a \*\*\*\* and you're like, yeah, I think I feel better. Oh yeah, I think that that's improved now. I think I have less anxiety. Okay. That's one way it could help, but also just telling yourself, hey, I know it's bad now. But if at any point it got worse, I could just reach out and fiddle with a \*\*\*\*. Believing that you would have control over the situation reduces your anxiety. People in the no illusion group, they could have told themselves something similar. They could have said, you know what, this is a BS scientific study. If at any point this gets unbearable, I'm just going to take the mask off and leave the study. That's perfectly allowed for them. Right? Like we can't force people into scientific studies. They're all volunteer. But like, oh, they probably weren't thinking of that. But they could have gained control over the situation and made themselves less stressed by like, oh, this is BS. Oh, I can just check out of here anytime I want. They wouldn't, probably because of a lot of their other beliefs about like, oh, but like they're paying me or oh, I don't want to upset this graduate students dissertation or social expectations. But sometimes things are actually under our control. But because of our other beliefs about oh, how I don't want to upset people or I don't want to seem weird or weak, then we fail to actually take into control things that are under our control. But this is an illustration of how a lot of this is not about how much actual control you have over a situation that matters. It is how much your brain perceives that you have control over situation. This is related to activity in a part of the prefrontal cortex, the ventromedial prefrontal cortex. It's medial. You can think of it as self focus and it's ventral, It's related to emotion. The more that people believe they have control over a situation that's potentially uncertain. The more activity there is in the ventromedial prefrontal cortex, the greater communication there is between the ventromedial prefrontal cortex and the midele. The more that you believe, well, let's say the less belief you have of control over the situation. Well, the midol is just running rampant because, oh my God, I can't breathe. And that's the people who didn't have the illusion of control. The mideles just taking over and triggering the hypothalmas and activating the stress response and all of that in the people who had access to the \*\*\*\*, because the light came on, that immediately activated their ventromedial prefrontal cortex. Like, I know it's difficult right now, but if we needed to, we could do something about it. And that helps the prefrontal cortex calm the imigdla down. And that is why they don't experience as much anxiety. And this relates to this notion of controllability. It's sort of related to like, well, how much is something voluntary versus how much is you're being forced to do it. And you know, if you're in the scientific stutty and you don't feel like it's voluntary. It is voluntary. But if you don't feel like it's voluntary, then it might be more stressful. And this also connects with some of the stuff we talked about last week. In terms of exercise because, and so that's why it's sort of cool like how these things interact with each other. For example, in one study they took rats and had them, or mice, I can never remember, but the study on rodents, they stuck them on a treadmill. I'm sorry. They gave them access to a running wheel. Which mice love running on wheels, like you're stuck in a cage. The love give them a wheel. Great. They love running on wheels. They just do it by themselves. Help them calm down. They like running around a separate group of mice. They gave them a treadmill and they said, okay, well you're going to run the same amount as the right mice on the wheel, but you don't get to decide when you run. We're going to tell you when to run and when to stop. So you're going to the same total amount of exercise. But in one group, they had control over when the exercise and the other group, the scientists had control. They found that in both cases, the exercise was beneficial to them. It's just that the voluntary group, the exercise was more beneficial. In particular, there's this one chemical called BDNF, or brain derived neurotrophic factor, that was related to how beneficial the exercise was. And all exercise, you know whether you're being forced to do it or whether you're voluntarily doing it like it's beneficial to you. And it boosts this BDNF, which is like fertilizer for your brain. It helps grow new neurons or strengthen new neurons to be more resilient against stress. But voluntary exercise increase it more. Why is that the case? Well, it makes sense when you think about the various reasons we might exercise. It's like the voluntary versus forced exercise is like the difference between running because you are hunting something versus running because something is hunting you. Okay? The exercise is good to exercise or not, but one feels more voluntary than the other. This is not to scale by the way, either size wise or temporally off by a few million years. But yeah, so the exercise is good. But what you are focusing on and either the potential negative consequences or your amount of control over the situation, like when you're chasing the rabbit, you can say, hey, you know what, I'm tired, I'm going to stop running. You can't as easily make that choice when you are being hunted. Therefore, it's crucially important to know like well, what do you have control over and what don't you have control over? Because we're can inadvertently get in our own way. Because in humans, all of the exercise that we do pretty much is voluntary. It just doesn't always feel that way. Because we're like, oh, I have to go to the wooden center, or I'll, you know, gain weight. Or like I'll have to go to the wooden center, or I won't be able to sleep tonight. Or I have to do it because my stupid professor made it an assignment. Great. If you want to blame me for like, I'm fine with it. I know it will still benefit you. It will still boost your BDNF will grow and strengthen neurons, particularly in the hippocampus, which is very sensitive to stress, so it makes your brain more resilient. But as long as you're exercising, stop telling yourself like, I don't want to be here. I don't want to do this. Like if you don't want to do it leave, no one is forcing you to do it. You're getting in the way of your brain, being able to harness the full benefits of that exercise. As soon as you realize like, oh, I'm in control of this, like I want to do this, oh, I want the benefits that come with exercise. Oh, I want to do well in this class. Oh, I want to have my sleep be improved. Oh, I want to, you know, have my body look a certain way. Okay, well then these are things that you are choosing and that changes your perceived controllability over the situation and therefore it's neurobiological effects. U, uncertainty is another big one. The reason why all of these situations are potentially stressful, either exciting or anxiety inducing, has to do with the amount of control over the situation. Or sorry, not just control but certainty. Like if this soccer player knows with certainty that they can kick the ball in the upper corner and the goalie is not going to be able to stop it. Well then they probably don't feel particularly stressed if they're like I've had a lot of Mrs. in practice recently. I'm not so certain about my ability to hit the target or I'm not so certain about how far the goalie can jump or where they're gonna jump. Well, that creates more stress. Whether that is exciting or anxiety inducing, depends probably on a like who you are. Are you cheering for that person to miss? Are you cheering for them to make it? Are you focused on how good the player is? Are you focused on how good the goalie is? These are all ways that we can shift our level of anxiety and excitement one way or the other. And, you know, test taking, like if you knew all of the answers, well, it's not stressful. Uh, it might be bad to tell yourself that you know all the answers and give yourself more confidence. If you don't actually know all of the answers, that could be not utilizing enough strength, stress. The reason why flirting with someone or asking them on a date is potentially stressful because you don't know for certain how it's going to turn out. You don't even necessarily know for certain what they are feeling about you. Like this person is talking to me like are they flirting with me? Or are they just being nice? Like you don't know. And they're like, if you knew for certain, oh, they're super into me. Okay. Then you could calm down and Okay, I just ask them out and it'll work out. Or if you knew, oh, they're just, you know, bored and they don't have anyone else to talk to. Okay, great. Then I'm not going to get excited about asking them out, but like it's that lack of uncertainty where you don't know. It's sort of like in, I think mafia bosses use this to good effect where you know a lot of shows about, you know, mob bosses, they keep people on their toes like they have threats of violence. I'm gonna punch you in the face. Ah, just joking, like well, if you knew for certain that your life was in danger, then you would leave, You would take evasive action. And if you knew for certain that you were safe, then you would feel relaxed. It's those moments where like, I think this is a threat but, but if I start running now, then maybe like something bad will happen or maybe they'll miss out on some good consequences. And it says uncertainty. That really activates your stress response and makes you more habitual and makes you less able to think clearly. Which is one of the reasons why people use power in this way to keep people around them uncertain. Because then they can't take decisive action one way or the other. Uncertainty and stress are definitely related. Increased uncertainty leads to increased stress. This particular study had people try and guess on a computer, which rock was hiding a snake? And if they found the snake, then they got an electric shock. So they were trying to not find the snake. And they measure their stress response as it relates to their pupils, because these are how much they sweat. These are both things that are controlled by your stress response. This way, like a lie detector might measure how much you sweat, also known as skin conductance. Your salty sweat conducts electricity better. And what they found is that when people had 0% chance of getting shocked because they were like given choices like well, you can choose this rock that you've seen before and you know there's definitely a snake. Or this rock where there's definitely not a snake. It's like, wow, no stress or at least baseline level of stress. I know I'm not going to get shocked. And so their stress response is kind of at baseline. As that uncertainty increases, we're like, oh, I haven't seen either of these rocks before. Like I'm not sure of this rock had a snake, You know two times but you know two times it didn't like there's total uncertainty. There's 50% chance, I don't know. The maximum uncertainty leads to your maximum level of stress. But interestingly, as certainty goes up the other way, meaning oh, you're more likely to get shocked, you're pretty sure you're going to get shocked, or you're definitely certain you're going to get shocked. Your stress response also starts to go to baseline, which is kind of weird because we'd be like, but shouldn't we not want to be shocked? Like, I don't want to be shocked. Yeah. But if you know for certain that you're going to be shocked, you can be like, okay, well that's not so bad. Like you can start accepting it because Yeah, Yeah. Well, who cared? Like, it's just a little shock, doesn't really matter. I, you know, I got shocked five times before. It didn't hurt me that much. So great I can just deal with it. And, you know, you can take that acceptance pathway if it's certain that it's gonna happen. Whereas, if it's, Uncertain maximally that it's going to happen. You don't know, should I accept this or whatever? Should I try and think per and if you know for certain that's not going to happen because you have full control over it, well then your stress is down here. So stress increases up to a maximum when there's a maximum uncertainty. Because we care less about bad things happening to us, then we care about the possibility of bad things happening to us. Because if we know for certain something bad is going to happen, then, oh, we can either figure out another way to deal with it or accept it or whatever. It's when that maximum uncertainty that creates maximum stress. Are there questions? Question? Okay, This slide just reiterates this point that both the lack of uncertainty and lack of control only really come into play if there are consequences. This study showed people neutral pictures like a table or a chair, or aversive pictures like someone trying to stab you with a knife. The Migdal responds more to, at dangerous situations. They just showed them these random patterns that were related to, uh, had some percentage likelihood that they're going to see an aversive picture or, or a neutral picture. And what they found is that if there's a lot of uncertainty, your brain doesn't really care. If the uncertainty is between, are you going to see a table or a chair? Who cares? It doesn't your me react the same either way. Like it doesn't matter. So you don't have any certainty about it, but it doesn't matter. But if it's like, oh guy with a knife, like oh, that just like makes your heart beat a little bit faster. Why? Because your Megill reacts triggers a stress response. And what they found is that when there were aversive pictures and there was either certainty that you were, oh, you're definitely the next picture you're going to see is me, kind of aversive. It's kind of like a trigger warning. Hey, this is going to be uncomfortable. Oh, then that activated the Amiga a lot less than if you were uncertain about it. By the way, this is one of the problems with sort of too many trigger warnings. If you expect like, oh, I should always be told that something is going to be uncomfortable, then yes, it does reduce stress to be told like, hey, this is going to be uncomfortable. But unfortunately, like most of the things that you experience in real life don't have that, and therefore you have less experience dealing with that. And so some people argue like, well, one of the best things to do is not to always try and tell people that something will be uncomfortable, but to help them be more resilient through that discomfort. But we can only increase our resilience through that discomfort if we practice it. This is a summary that like, yeah, your amidla responds most reactive to things that are potentially consequential, that are potentially out of your control, or potentially uncertain. Another way of looking at certainty and controllability and its effects on the Olympic system is not just through amid, but also other parts of the Olympic system like the anterior cingulate which we haven't talked about as much. And this plays a big role in our expectations. In this particular study, it's called the continuous performance task, where they just pop up letters on a screen and they say, every time you see the letter X that's preceded by an A, then you have to press the button as fast as possible. You don't need to memorize the details of that. But if you see any other letter, don't press the button. Or if you see the letter but the letter before it was something not a, then don't press the button. So you have to press the button as fast as possible, only in these specific situations. And don't press it in different situations. And the interior singulate is involved in a few different aspects of this. For one, every time we make a mistake, you press the button when you see an X and you're like, so there was a B before that, or you see the letter Y. Oops. Then you accidentally pressed the button. The interior singulate lights up because it's like, oop, we didn't want to do that. That was a mistake and its job is to notice your mistakes. But how does it know what is a mistake or not? Well, it has to know what goals you're trying to accomplish and it has to know what is. Expected you have to be able to know, did I get the right answer or not. What its job is doing is like if you were falling asleep in class and your professor said, hey, this is going to be on the test, you should know it. And you had a helpful friends like, hey, I woke you up. I think you just missed what he just said. That was really important. That is what the eringulaate is doing. It's like, oops, oh crap, we need to pay more attention. We're a little bit on autopilot here and it's alerting the prefumber cortex, hey, we need a little bit more processing power here. It also activates situations where there's a greater potential for making a mistake. So these are showing different blood flow responses through FMRI in the anterior cingulate and we see, oh, when we make an error versus when we get a correct, there's an increase in error response. It notices our mistakes and alerts us to them. It also activates in situations where there's a greater potential to make a mistake. For example, when you see the letter X, you're supposed to press it as fast as possible unless it was preceded by a B. In the situation where you see a B, you're telling yourself, okay, okay, if there's an X now, don't press it. There's a greater potential to make an error and so it's activating so it can alert the pre formal cortex like hey, we need a little more thought processing here or in the situation where you see an you're like, oh, I'm going to press it as fast as possible if it's an X and oh, it's a Y, okay? But those are the situations where you have greater potential to make a mistake. And that plays a role there. Because if we can accomplish all of our goals successfully without needing, you know, consciousness or higher level thought, then great, your brain is perfectly happy to go an autopilot through all of these things. It's just ah, when you're going an autopilot and you start to deviate where you expected to be, then your anterior single is like, oh, hey, we need to pay more attention. We can't just go on autopilot here, so that's a great feature of the anterior single it. But sometimes it gets in the way of our happiness because we don't really experience happiness based on the good things that happen to us. It's based on the difference between the good things that happen to us and the things that we expect to happen to us. In other words, reality minus our expectations. If we expect to get every single answer correct, then every one we get wrong, it's like boot the big jolt, deviation from expectation and the tracinglas going to be really active. The antral isn't the only one that's involved here. The nucleus acumbens plays a big role in this as well. As far as really to our happiness and well being and enjoyment. The Tracingla is more about our attention, like oh, I'm paying attention to that. And the nucleus decumbans is sort of about the rewarding or punishing aspects of that and the learning about what we should do as a result. Uh, because a lot of times in life we can have many wonderful things in our life, but they're always there. And we take them for granted, like having running water or a generally safe environment. Like oh, we don't even think about them at all, because we just take them for granted and we don't even notice them, we only notice deviations from that. And so if things are 99.9% of the time going perfectly like we have power all the time, you're only going to notice, you know, one day out of the year when you lose power. And therefore, instead of every day being like, oh my God, I'm so glad I have electricity. Like you only notice it when you lose electricity. And this is how our expectations can get in the way. And this is largely based on what is happening in the nucleus recumbents. The nucleus recumbent responds to rewards, particularly unexpected rewards. We're not going to talk about punishment, It's confusing because the nucleus deucumbents sometimes just talk about as a reward center. But it's really more broadly like learning. But when I talk about the reward centers, I'm talking about the nucleus recumbents mostly. And in this particular study, they only had good things happen or good things didn't happen, there were no punishments. But it was a gambling experiment where you either won money or you just didn't win money. Then they could change the percentage likelihood that you were to win money and adjust to the sort of expectations of what the nucleicummons was assuming would happen. And what they found is that when you had only a 25% chance of winning, so you're like, oh, I'm probably not going to win, but then you won. There's a big boost of activity in the nucleus acumbens. So these individual dots, so an individual person's nucleucumbs reactivity. And these lines, the modeled average across, across the different people and across conditions. So the blue line is showing what happens when you win. So here I have a low probability of winning, only 25% and I win. Boom, big increase. On the other side, I have a 75% chance of winning. Okay, I'm pretty sure I'm gonna win money, but then I lose. Boom, big decrease. So that I think makes all intuitive sense. But, and we know from other studies that dopamine plays a big role in the nucleus commons. We don't know from this particular study, because FMI looks at blood flow changes, not neurotransmitter levels. But one of the things that comes interesting is when we look at the extremes. When you have a 0% chance of winning, for example. So when you have a 0% chance of winning and you don't win, but there's not really much change in the nucleus cummins activity at all. You didn't win money, but you didn't have any expectation that you'd win money. Like I know, oh, this is the condition, I'm not gonna win money, so I'm just pressing the button. I don't win. So yeah, you're fine with that. But interestingly, on the other side, when we look at the places where you have 100% chance of winning money, you're guaranteed, You just need to press this button, you'll win $2 Your nucleus incumbents also doesn't react. Why? Because, yeah, you made $2 but you 100% expected to make $2 So there's nothing to learn there, there's nothing new about that or surprising. And this is how this sometimes get in the way, because oftentimes, like good things happen to us, you win money. But if you have a fully expect to do that, then it just doesn't enter your attention. It doesn't bring that spark of enjoyment. And that is why one of the most helpful things you can do to yourself is to actually pay attention to all the wonderful things around you and to stop taking them for granted, Just intentionally direct your attention to be like, hey, I'm glad there's electricity. Your brain is not going to do that for you. Your nucleus, incumbents and antersinga, they're not going to do that for you because these things are always there. But if you're like, ah, but I care about my happiness, then this is something that you can do intentionally or at least even create a habit of, so that it starts to become more automatic. And this is the concept of gratitude really, which is just directing your attention to the things that you appreciate are there and that you're glad are a part of your life. Gratitude has been described in many ways. You know, it can be just an attitude that you take or personality trait, or a coping response or an emotion. But the way I described it like there's two different things that we mean often when we talk about gratitude. One is we all, oh, I just feel so grateful that I had such a delicious lunch. And when I think about electricity, I don't feel grateful. Okay. There's the feelings that are associated with gratitude. Then there's the cognitive aspect. We. Are you guys glad? Raise your hand. If you're glad you have electricity, would you rather have not have electricity? Right. So if someone asked you, you could be like, yeah, I'm grateful for that. I don't feel grateful for it, but I am at a cognitive level. I'm glad that is a part of my life. And that is really important to understand. Because we don't have control over our emotions. But we do have control over, we're directing our attention a lot of times. And some of the researchers who first looked at the psychology of gratitude wanted to see, okay, well if we ask people to intentionally direct their attention to these good parts of their life or their day, how does that affect their mood? And had people keep journals in a variety of ways. Either write down three to five things that you're grateful for that day. Three to five things that annoyed you, or just generally what happened that day. And they found that when you specifically ask people like, okay, just think about write down at the end of your day, three to five things that happened. They could be big or small, they could be silly. Maybe they're more general traits that you have. Maybe it's something someone did or you did. Just jot them down. Just take a minute to write them down. That improved people's optimism about their life as a whole and for the upcoming week. It decreased their physical symptoms like aches and pains, and it even led them to exercise more. Do you have a question back there? No, just stretching. Okay, So this had a huge positive impact on their mood. And it was great because it's a very simple thing to do and you could do it daily. It's called a gratitude journal, though they did it this way. Not because this is the best way to practice gratitude, but this is an easy way to study. So you can feel free to keep a gratitude journal. You don't naturally have to do it every week, or I'm sorry, every day. You could do it every week, you could do it in different ways. But whether this is the best way to practice for you, well, that's something you could try, but we can show that gratitude is really beneficial. And importantly, gratitude is not simply thinking about how your life is better than other people's lives, because that's just a comparison. Gratitude is actually thinking about like, do I like this thing or not? So that's an important thing as well. Um, and when we practice more gratitude, it leads to so many benefits. Reduced stress and reduced anxiety and depressive symptoms. And we showed in the previous study, improved mood and outlook on life. It leads to improve sleep. There's a study in college students where they had them keep a gratitude journal. It improved the quality of their sleep and reduced their anxiety. It also reduces pain and physical discomfort because oftentimes when we're in pain, we're thinking about all the things that we can't do or all the things that are increasing our pain. Well, okay, if we just shift our attention towards the things that are good in our life, the things that we can do. I'm so glad I can still, you know, walk to class or Oh, that doesn't eliminate these negative things, it just shifts our attention. Because when it comes to gratitude, we often get stuck because we think the good things in our life have to do this, like cosmic battle with the bad things in your life. But what gratitude is really helpful for is realizing, okay, there can be bad things, that's fine. Your brain might even be drawing your attention automatically to those bad things. If you can fix them, great. Do it sometimes though, they are just bad things you can't do anything about. Okay, well, what happens if I just shift my attention here? I'm not trying to fix it, it just sometimes makes it easier. Because I'm shifting where I am, say on that yorkies Dodson curve. By focusing all these terrible things in my life, I'm stressing myself out. And if I just focus on some positive things, it can be really helpful not to deny or invalidate my own experience of the negative things. But just like, oh yeah, there are also these positive things, like having electricity doesn't make you pass your exams. Both good and bad things can exist at the same time. It's just that directing your attention to those good things is helpful. And if you express that appreciation to other people, or specific, or even about other people, it can be particularly powerful because our brains have evolved to care a lot more about other people than just random things like you might. Because we can have a relationship with other people in a way that we don't have with things like you might love your iphone but it doesn't love you back. Sara might tell you that she does, but she doesn't mean it in the same way as your parents. And in this particular study, they had them do the same basic intervention as we had you guys do this week of writing a gratitude letter. So they took people who were going through psychotherapy for depression and anxiety. And then they split them into two groups on for 20 minutes, on three separate occasions over three weeks. Just three different letters they wrote down thought someone who they're grateful for wrote a detailed letter, never even had to send it, and then three months later, they brought the people back. One thing they notice is the group that did the letter writing this was J. Again, three separate times of writing a letter. They had better improvements, 10% better improvement from the therapy. But they also stuck them inside an FMRI machine and had them play this game where, like, sometimes good things happened and sometimes bad things happen. And they had to rate like, well, how good do I feel? And what they found in the anterior singulate cortex of the people who did the gratitude letters, their anterior singulate was more reactive to positive events and positive information. Why? Because when you take the time to actually write down the things you're grateful for, whether it's in a letter or you're going to tell someone or you write down a gratitude journal, you're taking action to express the gratitude. It basically sends a signal to your brain like, oh, I guess this is something we're doing now. Oh, okay, I guess I should pay more attention to that, right? Like when you actually create an intention and follow through, then your anterior singulate knows oh, oh, that's something that's relevant. Oh, I should pay attention to that. In a similar way if you test drove a car and then you all of a sudden you see that same car everywhere the next day because you took action. Your Anisingula's like, oh, I guess that's relevant. We should pay attention. And keep in mind this was three months later, so these had long lasting effects. So, uh, I hope you find that useful. Don't try and deny your negative emotions, but just sometimes it's helpful to find gratitude. This is just the intervention for this coming week, so you can keep doing your gratitude journals today if you haven't, but starting tomorrow, you can do this mindfulness intervention and your TAs will talk about that in class. So thank you. And I am saying that to benefit myself as well.

# Week 3 lecture 2

Okay, slide show. Okay. So today we're going to keep talking about stress and some of the psychological factors that influence stress. If you have questions, definitely raise your hand or stuff that you were confused about last time. I want to clarify, definitely let me know. All of this, of course, is related to the Limbic System. I just wanted to touch on, as a reminder, some of these regions that we've talked about, we've talked about this concept of homeostasis a lot. Which is what your body needs to survive. The hypothalamus is the key region responsible for that. And it's monitoring your temperature and your blood sugar, and your oxygen, even your social connection with people. The Limbic System is a set of structures that's closely connected with the hypothalamus, which is why it evolved in the first place. So that we could be better able to survive. Your emotions helped you be better able to survive and learn from your experiences and adapt and be flexible. The emigdla closely connected with the hypothalamus. I know some of this is repetition, but these are the key things that we need to understand. The Migdla is really paying attention to threat. Things that are potentially out of your control or potentially unpredictable, that have potentially big consequences. These are the three C's that we talked about last time. Controllability, certainty consequences. These are all things that get your limbic system fired up, particularly the Migdla. Why? Well, because if you think about what life would be like without the Migdla, you just sort of be waiting around for things to happen. To be in pain or to have your oxygen levels be dropping or your blood sugar be dropping. And then, yeah, the hypothalms could trigger the stress response to then say, oh my God, we should do something about this. The mila is like, hey, maybe we should try and anticipate some of that stuff so we can trigger that same cascade of responses and prevent bad stuff from happening. And the hippocampus is, it's trying to learn over time. Basically, anytime something triggers your emotions, activates the emigula strongly, it nudges the hippocampus. I mean they're all just, they're connected, they're very closely located next to each other, the neurons and signals to each other. But essentially it nudges the hippocampus like, hey, maybe we should remember that for later, that seems important, the hippocampus, it then it is like constantly monitoring your situation for things that are similar to what you've already experienced. And when it sees similarities, it says to the Amigo, hey, maybe we should feel like we felt the last time this thing happened. Because then we should do what we did the last time and the anterior singulate, as I mentioned last time, is it's constantly monitoring for things that are deviations from expected or deviations from your goals. If you're walking down the street and making clear progress towards your class or whatever your goal is, you don't really need conscious awareness to accomplish that. You can be thinking about whatever you want. You don't really need to be aware of what you're doing. But if all of a sudden you like trip, then oh, that was a mistake. Oh, you expect to just go smoothly? That was a mistake. I activate the anterior cingulate. Anterior cingulate is like, oh, we probably need to pay attention to what we're doing more. And it signals the prefrontal cortex like hey, we should think and pay attention more to what we're doing. But you don't always need awareness like the brain basically evolved on this principle. If you could just get by on autopilot, why make it more complicated? And the anterior cingulate is, essentially, its job is to notice like can I make it by on autopilot. Like if you're doing a good enough job, then you might not even notice slight deviations. That's why, like you wouldn't notice if the sidewalk was just like very slightly different. Like you put your foot down, it's basically where you expected to put your foot down. You don't even notice that there's a slight hail or whatever. It's only when it's enough of a deviation from expected that the anterior singular is like, oh, this is a mistake, this is wrong, we need to pay more attention. And that often then triggers other emotions because, you know the hippocampus has familiarity with like, well, how did you feel in other situations where we made mistakes and that triggers the amygdala, and that triggers the stratum. So this is how it all sort of fits together. The sort of overall principle though, that defines the anti singulate response because it does a lot of different things. It's involved in directing your attention to personally relevant information, including mistakes. Why are mistakes relevant? Oh, if your goal is important to you, well then mistakes are relevant because that means you're not making progress to your goal or pain. Pain is relevant because it means, ah, something's going wrong that I'm not dealing with. A lot of what your brain is trying to do is figure out what information is relevant to me or not. What's the information that I can safely ignore and filter out, so I don't even pay attention to it because it's just a distraction from the things that are relevant to me. This is one of the reasons why practicing gratitude oh, boosts interior singulate activity to positive information because there's good stuff happening to you all the time. Oh, we have lights in here you didn't notice? Didn't care because it's not relevant. Who cared? Yes, of course, we're going to have lights. Why would we expect otherwise? But when you take action to express your gratitude, then all of a sudden it's an intention, it's a goal. And your interior singulate, it's like, oh, I guess that stuff's relevant to us now. I guess I should pay attention to that. Okay. If you make me. So this is, it works very similarly to how like social media works. Like, I don't know, Facebook or instrument. They're just like showing you random stuff from your friends accounts or from random ads or conspiracy theories or whatever. But then when you click on something, the social media algorithm is like, oh, okay, I guess that's relevant. So we're going to show you 1 million things like that. That is what the anterior cingulate is essentially doing. It's filtering out most of the stuff that's irrelevant and the actions that you are taking or the intentions that you're creating or the environments that you're in, or the emotions that you're having all affect the algorithm. What it decides like oh, I guess this is important, I should pay attention to this. Or like, oh, I can safely ignore that. That's sort of how the whole limbic system fits together as an overview. But there's another key part of our emotional experience. It's not technically part of the Limbic System, but it's very closely connected to it that I wanted to talk about. The insula is responsible for processing physical and emotional sensations from our internal organs. If we're looking, see the cortex here on the surface of the brain. This big crack on the side here is a fissure that, where the cortex goes in and the insula is located in that crack. Um, it was called the insula initially because it is a piece of cortex and they can tell that cortex is different from sub cortical tissue, from other parts of the brain by looking at a microscope. Oh, this is cortex. But it was weird because, well, most of the cortex is like on the surface. You can just see it when you look at the surface. And the insula was this piece of cortex that seemed to be floating off by itself, deeper in the brain. They call it the insula from the Latin word for island. Um, but because the cortex is one continuous surface, it's actually technically a pendintula, geography joke there, because the cortex sort of plunges inward and then comes back out. So it's one continuous surface. The surface of the brain, but it's just like deep inside because the brain is so curvy. It right, it's part of the temporal lobe on the side here. It sits right next to the amygdala and the hippocampus, and it's very closely connected. It's not technically part of the Limbic system because it's part of the cortex, but it's a key component of how we experience our emotions. As you recall, the stress response triggers a lot of changes in a variety of our internal organs. The insula is responsible for processing the sensation or awareness of those organs. The stress response is going down from the brain down. The insula is a sensory, it's processing from the body up like we talked about the Vegas nerve as being important in breathing. We like the gave a lot of the information from the Vegas nerve. It's go into all your internal organs like huh, how is my stomach feeling? How fast is my heart beating? All of that stuff goes up to the insula which processes that emotional information. My neuro anatomy professor in grad school, I remember he described like we have different ways of processing physical sensations. The example he used was on the skin, on your face. Like if, if you put a finger here or someone put a finger here or here, or put two finger, then you close your eyes, you could be like, oh yeah, I feel one finger right on my cheek bone. Oh, I feel another one here. Oh, there's something on my ear. It's just a cognitive awareness. I like, yep, there's something touching. I feel it. I know where it is, I know where it is in space. I know what it feels like. Oh, it's rough. It's smooth. Whatever that is processed by the primary somatosensory cortex. Like it's super critical, but it's not interesting as it relates to your well being or this class. But instead of that sort of critical processing of information, if someone were to like gently stroke your face or your ear, or pat your head, oh, that feels nice. Well, like the emotional part of it, they think, oh, oh, that feels nice. That's process by the insula, the emotional component of those physical sensations. It also is involved in pain, if someonre to poke you in the eye. Ah, it's not just like, oh, someone is poking me in the eye or I think as I say in the book, like, oh, my hand is caught in this car door. Yes, there's one part of it and it's like, oh, my hand is here. I can't move it. It's stuck. And there's another part of it, it's like, ah, so that a part is processed by the insula. Same thing like with your heart. Like you could notice your heart beating fast and it's beating fast. But when your heart is beating fast, we don't just have this logical awareness of it, like no, it feels like something, it creates emotions. So those emotional awareness of our internal organs are very much intertwined with our emotions. Because it is our stress response and our emotional reactivity that triggers those physiological changes. The psychologist William James, who's sometimes called the father of American psychology, he wrote about some of this stuff back in the 19th century, like 150 years ago. And they didn't understand all of the neuroscience and how the stuff related to the brain, but he was perceptive and pointed out how most of what we call emotions like, oh, I'm scared, I'm excited, whatever it is. Um, he pointed out like they're mostly made up of physical sensations. And I'll quote him here because he says it well, but also he uses like nice old timy language. That's kind of fun. He said what kind of an emotion of fear would be left. He says it weird, like, you know, what would fear fear like? But like what kind of an emotion of fear would be left if the feelings, neither of quickened heartbeats, nor of shallow breathing, neither of trembling lips, nor of weakened limbs, neither of goose flesh nor of visceral stirrings were present. It is quite impossible to think like, what would it mean to feel afraid or feel fear if you didn't have a racing heart or if you didn't have squirming in your stomach or tightness in your chest or, you know, jittery muscles. Like if you removed all of those sensations from fear, what would it mean to be afraid? And that's sort of hard to piece that together. And this is just emphasizing like this is the role that the insula plays in our emotions. It's like, yeah, it, one of the most common anxieties and fears that people have is about public speaking. One of the treatments for it is something called beta blockers. But one of the interesting things about beta blockers is they don't target the brain. The target the slow your heart rate down a little bit. So you go up on stage, you're still like, oh my God, everyone's gonna think, I'm terrible, I'm boring, I don't know what I'm talking about, but your heart just isn't like beating out of your chest quite so much. So you just, you don't care as much. Like you don't, you don't feel it as deeply. So maybe you still technically have the same anxiety about public speaking, but it doesn't just feel quite as scary. And so therefore, it's easier to focus on what you're doing. And that's because it's sort of breaking this feedback loop, where the insula is paying attention to what your heart is doing. And it's like, oh, I guess my heart isn't beating as fast, I'm not as scared and it's communicating that to the Olympic system and so on. So this is important because our emotions are important in our survival. And both, well, we need lots of things for survival. We need to avoid danger, but we also need to eat food and drink water. So we have to avoid certain things and approach and be excited about certain things and those, our emotions help with all of that. If you are, um, you know, you were a human 50,000 years ago on the savannahs of Africa. You're like looking for food because you're hungry and you want to find food. Like you have to be able to see through all of the noise in the brush to be like, oh, there's, you know there's a word hog, I'm going to go hunt that U. But you may have noticed this sometimes when it feels like you are trying to accomplish a goal, probably don't do as much hunting as humans used to do, but you probably have a lot of goals that you're trying to accomplish. Sometimes your brain distracts you with all this negative information like, oh, you could fail, or oh, that's a stupid idea, or oh, there's a huge problem with that, You're missing this other thing. It's like why is it that we're constantly distracted by this focus on the negative? Like, oh, I could just accomplish so much more if I just stop being so negative and pessimistic and just was so positive. Well, there's a reason for that because while you are hunting this four, you have to be or Warthog or whatever it is, you have to really notice like all this grass around, is there something in that grass, like, is that grass waving in the grass? Is that irrelevant? Because it's just how the wind is blowing or like, oh, is that crucially relevant? Like there's a lion right there. Like, oh, is that waving? Is that waving so grafts or is that waving lion's mane? And a huge part of the reason your Olympic system and the insulin involved, your emotions are involved because it's like, yeah, it would be nice to succeed on your hunt, but it's really crucially important to not get eaten by a lion. And these systems are often working outside of your conscious awareness because they're constantly scanning the environment for things that are potentially threatening or based on your previous experience you've encountered problems with before. And so, you know, we need to pay more attention to them. Uh, so like the things that we see, a process just like the things that we feel are processed in multiple ways by the brain, our ability to see things like, oh, that guy's wearing a black hat and like, oh, there's a red carpet and the doors partially open. Like that aspect of seeing is processed by the occipital lobe in the back of the brain. You know, this is one of the primary primary sensory regions, the primary visual cortex. We don't really talk about those things much, but the Migdal in particular is also looking at the same video feed. And it is constantly just be like, hey, does anything look like it's a threat? Does anything match like what we've previously experienced before? And it reacts to that information faster than you can even be consciously aware of. And I really like this picture that I saw someone posted online a while ago because it really captures why this is crucially important. Because like if you're just looking at it, you're like, okay, what am I even looking at? It's just like leaves and sticks in the ground except for like where can you even see it? I can't even see it, even know it's there. Like oh, here's the tail of a snake. And the snake goes all the way up here and then it like hurls around and oh, its head is like, right? Oh, there's a head. Like I even know it's there and I can't even see it. But it's like really crucially important if you're like walking along to like to have your Migdla process that potential threat. And there's not enough time to like alert you consciously. Like oh there's a snake there. Oh, snakes are bad. Oh, should guess I should move somewhere else. Like no. What you're doing is you're walking along, the Amigdula perceives the snake there or there's some little wiggle in the grass and you jump. And it's only after you've taken evasive action. But you notice, oh my God, my heart's pounding, what has happened, like oh, there's a snake there. Because if it didn't happen that way, then you would get into dangerous situations. More often, the brain sort of evolved on this react first, ask questions later mentality. Because it's safer to jump and avoid a snake than it is to step on a snake and be like, oops, I should have avoided that. And interestingly, because these things react so fast and there's such big consequences like if you get it wrong, that means sometimes you're walking along the forest, you know, on a trail or whatever, or whatever goals you're doing. And you jump, you react. You have a strong emotional reaction. And a physical reaction that happens before you're even consciously aware. And then you're like, oh, that was just a stick and you could get mad at yourself. Wow. But it's so stupid. Why did I react as a stick? I'm just an idiot. That wasn't dangerous. Yeah. But like, because it's way more evolutionarily advantageous to overreact to a stick than to underreact to a snake. And because the information that we're getting is, you know, so complex and like even if you're staring at it, you can hardly see it. Yeah. Your brain is sometimes going to make those decisions to err on the side of caution. So when you have an emotional reaction, sometimes we're consciously like, oh, that was stupid. It turned out fine. Why was it even scared? Well, like when you have an emotional reaction, it means there's something that your limbic system is perceiving that is consequential I E, important to you, that is potentially out of your control. You might then realize, oh, actually I have control over this, whatever. But like your limbic system doesn't follow the same logic. But this brings me to three related concepts that I just wanted to provide a little bit more distinction and clarity on. And they're fear, anxiety, and worry. And these are things that we, in our language we talk about. We know they're kind of overlapping. It doesn't really matter technically like what they're called. I don't mean that you have to be more precise in your language. I just want to help you understand like, oh, these are driven by sort of different brain processes. Fear is a feeling, in response to imminent danger, there is something dangerous. Someone is coming at you down a dark alley or you know, points a gun at you like, that's a dangerous, you're walking through the forest and there's a lion that is, you know, walking down the path towards you. It's a response that you're perceiving. There's a dangerous thing here. I need to do something about it. Either I have to freeze so it doesn't see me. I have to run. I have to do something that the sympathetic nervous system involved for the fighter flight or freeze response. And this is tried. It's a cascade triggered by the hypothalamus. Can be caused by previous experience or activation of the amygdala. You noticed a mistake or something that's like causes something in the limbic system triggers this cascade that activates the stress response. Anxiety is very similar to fear. In the end result is that it's the same activation of the same brain regions and physiological reactions, but it's engaging that same circuitry in response to the possibility of danger. You know, obviously it sucks to be afraid to feel fear. It's not pleasant. But there's something positive about fear in that it's motivating to take action, and it helps you take better action and stop worrying about that exam that you have next week. I got to focus on what I'm doing right now, not get hit by that bus or whatever it is. So it's very focusing and motivating. And it's also time limited because when you are in danger and you're feeling fear, well then either you succeed and it's, oh, I got away from that line, Oh, I got out of that situation. Ooh, I jumped out of the way of that bus. You either succeed, oh, and you're no longer in danger, or you fail and you die, and you don't have to worry about it anymore. But it's at least it's kind of a binary thing, like either you succeeded or you didn't and it's going to all be over, you know, in a very short period of time. The problem with anxiety, however, is that the possibility of danger is ever present. You could feel anxiety for as long as you want. Like if you're walking through a field and you see a lion, well, you got to freeze. So who doesn't see you? Or you got to run away? Like there's a limited number of reactions, a limited amount of time. But the entire time that you're walking through the field, or even thinking about should you walk through the field? Or even times when you're not walking through the field but planning ahead like, oh, how am I going to find water? How am I going to do this? Well, you could be experiencing anxiety about the possibility of encountering a lion that whole time. And this, unfortunately, is much more related to chronic stress than acute stress. Fear is an acute reaction of the stress response. It goes up, it goes down in, unfortunately lead to chronic activations because you're always anxious. However, anxiety is not always a problem. Anxiety is a good thing because it prevents us from being in dangerous situations unnecessarily. I think in the book I describe, you know, two cave men who, like came across a cave and one was like, hey, it's a great place to sleep. And he walked in and the other one was like, I'm not so sure And the first one was like, oh, stop being such a scary, you know, scaredy cat. And he walked in and got eaten by a bear. And like the second one is your great, great, great, great, great grandfather. Because, well, the thought of walking into this dark cave with uncertain about what would happen, and unknowing if he could, you know, defeat a potential bear that might be in there. Well, that made his heart beat a little bit faster. He made it a little bit tense. And the activated anxiety, he's like, I don't feel good about this and that is a extremely helpful response. The only problem with anxiety is when it becomes like, prolonged or out of, out of proportion to the actual amount of potential danger that we are in. But it's crucially important to realize like anxiety evolved for purpose, you need anxiety. Or you would be putting yourself in stupidly dangerous situations all of the time. And in fact, maybe you have some friends who are like, yeah, they're doing stupid stuff all the time because they don't feel enough anxiety. And this is often subconscious by the way. I can see the snake and not even be consciously aware of it and react. My big can trigger all of that, passes that information along to my stratum, which takes evasive action before I'm even aware of it or can think about it. The actions that we take as a result of anxiety can be out of our awareness. Like someone with PTSD, for example, you got mugged in an alley once. Uh, well, if you're walking, you know, to get to your car and there's a short cut down an alley, you might not take that shortcut. And if someone was like, hey, why are you avoiding that alley is because you got attacked in an alley before And you'd be like, Judge, what are you talking about? I'm not avoiding that alley. I was just like, oh, I'd rather walk around the block because it's cleaner and nicer. Like we come up with whatever reasons we have to explain our actions. You could have a no awareness that you are avoiding anything. Your brain's like, oh no. Let's just let's just, you know, do this other thing instead, just like, you know, you might not think that you're avoiding going to a party. You're like, no. I just, I'd rather I'd have more fun hanging out by myself playing video games, right? Because the thought might create some anxiety. And that anxiety then triggers habits. And those habits exist to help you deal with that anxiety. Sometimes that gets in the way, and you're not even consciously aware of all of the ways in which your anxiety is triggering your decisions because it happens so fast outside conscious awareness. By contrast, worry is very much similar to anxiety, but whereas an anxiety is the activation of the limbic system that either makes us feel or take action in response to potential danger or threats. So you can take action even if you are not aware of why you are taking that action. You can come up with a story of why you're taking that action that may or may not correspond to your actual emotions. But by contrast, worry is a cognitive process and as such, it's more mediated by the prefrontal cortex. And it's more about communication between the medial prefrontal cortex and the anterior cingulate. Because it's thinking about the possibility of like, oh, is that a good idea? What could go wrong? Oh, that could go wrong, that's a bad thing. They are very much related though, in that they can also trigger each other. Because when you're thinking of all the stuff that you have to do, and then you start thinking about, oh, that could go wrong. That could go wrong, That could go wrong. Like that is a very helpful trait to have. Think of it like playing chess. Oh, I could make this move. Oh, then the other player, they could move here, then. Oh, they could move there. Oh, that's not a good idea. Oh, maybe I should move my castle, whatever, like. Oh, it's very helpful to be able to think ahead and see all the potential things that could go wrong, and if our limbic system activates more because of it, oh, it helps us pay more attention to that thing. Oh, if I, you know, walked across that field, oh yeah, there was a lion there last week. Maybe I should walk a different way. It helps us avoid danger and use our powers of thinking and foresight to actually you think about the things that could go wrong. So we could potentially avoid them. But often that worrying about something then triggers anxiety where the miklos like, oh my god, that's a terrible thing. And then that triggers habits and evasive action and whatever. And then that causes further problems. Sometimes it's the other way where we are experiencing anxiety that we're not naturally consciously aware of and that triggers worry that That doesn't always make sense. But if you think about the prefrontal cortex, job is to regulate these lower level regions. Well, activating the prefrontal cortex helps calm down the limbic system in many ways. There was something I read about worry that was really surprised me when I was writing my book, which is that worrying decreases reactivity of the limbic system. Particularly A. And I was like, what? That doesn't make sense. Like when you're worrying, it seems like you should be more emotional. And that's why it's helpful to understand the difference between anxiety and worry and sort of their relationship. So the hardest thing is kind of just to experience anxiety and just be like, yep, let it just wash over me. It's much more helpful to think about it and plan. There's something I could do differently. So how could avoid this? How could I get out of the situation? And that is what worrying is. The things, however, that you are worrying about may not actually be directly related to your anxiety. Like you might be anxious about your birthday party because you invited a lot of people and not a lot of people RSVPed and you don't know if everyone's gonna show up. And that kind of means like, well maybe you're not as popular as you thought, you don't have as many friends as you thought because you're not really at a fundamental level lovable. Okay. I'm not saying that's true, I'm saying that is an anxiety that you might have, you might not even be consciously aware of it. Um, and that creates a lot of emotional responses and your prefrontal cortex. It's like, oh, I know what we could do though. Like I could just make sure like the cheese plate is really well organized and the napkins are really well aid out. So you're going to be focused you're consciously focused on all of these other Oh, are the decorations hung up? Oh, the cheese. Oh, I got the wrong kind of cheese. Oh. And that can trigger other anxieties. Okay. Because it is easier to think about things that we have control over or to think about things that aren't as big and over present. So it's easier to worry about things like, did I get the right kind of cheese or did I get enough non alcoholic beverages? Because those things are easier to worry about. And focusing on things that are, we can control, I can worry about that. And I can go to the supermarket and get teas, I can do all these things. And I have some anxiety about that because that anxiety is related to my deeper anxiety about whether I'm lovable or not, but that I would have no idea how to fix or whatever. So instead I'm going to worry about this thing that's kind of related but not really. This is why you've probably found it very unhelpful. If you are worrying about something, for someone to say, hey, don't worry about that, don't worry about that. You can try this with your friends if they're worrying, you say, hey, just don't worry about that. It's unhelpful because worrying helps reduce anxiety, whether it is the direct cause of the anxiety or not. And if you just stop worrying, then your anxiety will go up. You're not worrying for no reason you're worrying because there is anxiety. It's just unfortunate that also that worry can trigger more anxiety and that anxiety can then trigger more worry and we get stuck in this loop. But you can't break out of it just by saying like, okay, stop worrying. You need to acknowledge the deeper source of the anxiety and find some other way to better deal with that anxiety. And I just wanted to illustrate this in a cool study of generalized anxiety disorder, where they took people who had generalized anxiety and just healthy controls who had, you know, regular anxiety. Because as I said, like everyone has anxiety, you need it to be human. Whether it becomes pathological, okay, that's a separate issue. But sometimes we're like, why am I anxious? You have a human brain. The human brain has anxiety. And Uh, and whether it's a diagnosable level to some, you know, clinician. Oh, that's a separate question and also isn't always helpful because like at some level it's like, well, you're feeling anxious right now. Does it matter if it is, you know, cl only because you have a clinical anxiety or just like, oh, it's just normal anxiety? Well, over time, yes, it matters because I should maybe go do something about it and not handling it myself. But at any given point in time, it's just you're experiencing anxiety. And the reason why I say that is because sometimes people are like, oh, I don't have clinical anxiety. Therefore, I don't need to do anything about it. Well, you can still do something about it. We don't need to say like, oh, have this bright line were like oh, I don't have clinical anxiety. So therefore, I'm just lazy or you know, worried and need to get over it and stop being such a loser or on the other side sometimes like oh, I have clinical anxiety, oh, there's nothing else I can do, I'm broken. It's like, well now the brain, it doesn't make those black or white distinctions. So in this particular study though, they took people with anxiety and without anxiety. And they gave them specific things to think about that might trigger their anxieties. Like think about the chances of losing a loved one. Or think about the chances of failing an exam. So this might trigger some anxieties that might also cause you to worry. Maybe some of you are like, oh yeah, I have an exam tomorrow and all those things you're thinking about, those are worries and the things that you are feeling or all the physiological responses that you might not even be consciously aware of. Those are the anxiety piece and what they found when they looked at this medial prefrontal cortex region, that whether people had the sort of deeper clinical anxiety or not, they all activated the medial prefrontal cortex when they were worrying about these things. Because we all have the same brain circuitry and it's all connected in essentially the same ways. So they describe these as people who worry a lot because they have a general anxiety disorder. And people who don't worry as much because they just have regular anxiety. The key difference came from when they told the people to stop worrying it, okay, you can stop thinking about that, now you can stop. And the people who didn't have this clinical anxiety, oh, they're able to turn it off. They're like, okay, great, I'm think about something else. Whereas the people who had anxiety weren't able to shut it off, the anxieties were already triggered. And therefore, that's why they kept worrying because the anxiety didn't go away and now it's activating this worry. And they can't just disengage and that's when it starts to become a problem. And this is a great, great comparison to that analogy they talked about previously of the microphone and the speaker. When you're talking into a microphone, what's supposed to happen is that you talk and then sound comes out of the speaker. And then you stop talking and sound stops coming out of the speaker, right? That's how it works. But if the volume is turned up a little too high on the speaker, then you start talking and sound comes out of the speaker. And then it keeps going back and back and gets stuck in this feedback loop. So both people with anxiety and without anxiety, like okay, we have the same function, the speaker in the microphone, they're working in basically the same way. It's just, oh, if you haven't generalized anxiety, it amps up the volume and then it gets stuck, that feedback loop. There are many ways to try and rewire that. Some of the things that we've already talked about in this class can be very helpful like exercise and sleep, and slowing down your breathing. Or even practicing gratitude. Right? All these things can turn down the volume a little bit. There are bigger treatments, however, there are many types of forms of therapy through your problems. Getting insights from an expert that can be extremely helpful. Uh, I should put this slide in the opposite order, because the first kind of talk therapy that was developed, or the first formal kind of talk therapy was developed by Freud. Where he's like, oh, all these people have these weird medical conditions. Oh, and they're all women. Oh, it probably can't have anything to do with the repressive patriarchal society that we live in. It's, you know, it's like, oh, it must be their uterus is like causing these problems. And the Latin word for root for uterus is hissed. Like hysterectomy is when you get your uterus removed. And therefore, these problems were originally called hysteria. Oh, these women, they're experiencing wandering uterus that's causing all these problems. And Freud was the first person like, huh, well let's just try talking to them and seeing like what's going on, like what they're thinking about. And magically solved all of these physical problems. The talking cure. That has undergone many revisions since Freud first came up with the idea, and a lot of his ideas about how it worked, uh, aren't necessarily true. But the basic fundamental idea that's true is that if we start to uncover the unconscious meanings and beliefs that we are holding onto, then often these problematic behaviors or physical symptoms that we have will just go away because there are our body trying to deal with these anxieties that we have that we are not consciously aware of or thinking about. And just by talking to someone in a helpful process, it can resolve that. That's psychoanalysis or the psychodynamic approach many years later, and that was very effective, but many years later some more research minded people were like, ah, but there's okay, that's really individual for everyone and like it takes a really long time, there's got to be something we could do to make it like, quicker and faster and have it be more reproducible. And this is where cognitive behavioral therapy evolved because they realized, oh, well, sometimes people's problems like the emotions that they're having, uh, the impulses that they're falling into, they're caused by certain thoughts that they are having, incorrect thoughts, or they're taking actions that are making the problem worse. And if we just help them realize, hey, just oh, you're thinking you got to be on a test. And so you're thinking, oh, I'm going to get a on every test and I'm gonna probably keep getting worse and they're gonna fail like, oh, we don't need to explore the depths and the origins of your fear of failure. We just need to help you realize, oh, that's incorrect assumption you're making. That just because you got a B or a low grade on this one test, that you're then going to get a low grade on every test. And if you could just realize that cognition, oh well, then you could stop from falling into that pattern. Or if you could realize like, oh, well, every time I too poorly on a test, then I stop studying as well for the next time because I'm like, oh, well I'm not going to do well, Like oh, well that's an unhelpful behavior and cognitive behavioral therapy is focused on, well, let's address those unhelpful thoughts and unhelpful behaviors. They might be triggered deeper down by like these beliefs that you have about yourself in the world. But that's all we need to focus on is just these unhelpful thoughts and behaviors and like, what are these beliefs? You don't need to get into the past and like why all of these things happened? And that was really embraced by scientists because you could do that in a much more scientific way and you could sort of have a recipe like, okay, in session one you do this, session two, you do this, it is extremely helpful. My take on it though is like, yes, both approaches can be helpful like, uh, sort of like if you have a leak in your roof when it rains, you could just pick up, well, let me just put a bucket under it and then then it doesn't ruin my floors. Perfectly reasonable solution. That's sort of the more cognitive behavioral approach. Whereas the psychodynamic approach is like, well, let's actually figure out the source of the problem and then you won't leak in the first place the certain things because you can't really know what the actual sources. Sometimes one is better for people, sometimes the other is better for people, or sometimes both approaches are necessary. It's just that because cognitive behavioral therapy is easier to study, it has a lot more scientific evidence behind it, like a treadmill or a stationary bike. Those aren't the best forms of exercise, they're the easiest forms of exercise to study. So that's just sort of important to keep in mind. There is a lot of evidence of psychodynamic approach being helpful, but it's not as easy to study and there are fewer scientific studies around it. So we're going to focus, right, mostly now on cognitive behavioral therapy just because this is easier to describe these approaches. Although I would say the overall approach that we're taking in this class is kind of a dynamic or psychoanalytic one of like, yeah, this whole time if you're just reflecting on and trying to understand yourself better, well then over time some of your problems might just go away. But on a practical level, it's much easier to implement suggestions and tips and mindset shifts. Cognitive behavioral therapy is about developing better coping strategies that better address the unhelpful thoughts or behaviors that you are stuck in, so that they can then lead to better emotional state. There are many strategies for this and there are many flavors of cognitive behavioral therapy that kind of address these in different ways. You can change your awareness, there's mindfulness forms of cognitive behavioral therapy. Or you can change your behaviors, like, I'm just going to start going for a run every day. I don't need to figure out the source of anxiety, but oh, maybe if I just go for a run every day, then the anxiety doesn't bother me as much anymore. Some of them are more cognitive about what you are thinking about, some of them are more behavioral about what you are doing. One of the things that is in a lot of cognitive behavioral approaches is this idea of cognitive reappraisal, where you know, you can't control what thoughts pop into your head. But you can notice, just like the test example I got, I failed this test. Oh, I'm going to fail every test. Oh, that's actually not logically true. I've got, as on most of my tests, so this is just a one time thing that is reframing that it could be true that you could fail every testament, that could be true. You're like, oh, but it's not helpful and it's also unlikely. And so we can reframe those thoughts and identify beliefs that we have that might be unhelpful, like oh, well someone who's really smart always gets a's. Mm. That might be why you're having such a strong emotional reaction to getting a B, because that's actually an incorrect belief, like someone could be super smart and still get a B. But if you have that belief that like, oh, smart people always get As, then you're going to have a much more strong emotional reaction to getting a B. And the goal of this class, in sort of a therapy, is like to train your brain to work for you instead of against you. This is one of the things William James said was the great thing in all education is to make our nervous system our ally instead of our enemy. And other examples of cognitive reappraisal are like growth mindset that we talked about previously of like, oh, I'm not good at math yet. Like oh, might be not good at math, but should I try harder or should I give up? There are many types of unhelpful thinking patterns that we can fall into sometimes in cognitive behavioral therapy, they're trying to help you identify, oh, what's, what's that pattern. I generally tend to think of it as like, well, you just need to, you don't need to actually clarify what kind of unhelpful pattern is. All you need to notice is like, oh, is that helping me accomplish what I'm trying to do right now, or is it unhelpful? You can sort of think of it like a friend is saying something to you. Like you're trying to schedule your classes, let's say. And your friend is like, oh, but you could get hit by a bus tomorrow. So like, do you even need to do this? Like thank you. That's true. I appreciate you caring about me. But that's not helpful for right now because I'm trying to schedule my classes. So some examples include like all or nothing, or black or white thinking, right? Like either I have an anxiety disorder which means that I am broken, or I don't have an anxiety disorder, which means that it's all in my head and I just need to snap out of it and blah blah. Okay, Well, the truth is, life is gray. There aren't just these black or white distinctions I remember. Um, when I first started dating my wife, she didn't text me back as quickly as I would have liked. And I remember talking to my friend and I was like, I just started dating this girl and like she's really awesome and like sometimes like she seems like totally into me and like we get along really well. And like other times it seems like she doesn't really care about me or doesn't like me at all. And he was like, yeah, I'm sure it's one of those two options. Like I was like, right, like we think you're black and white. Because it makes it easier to make sense of the world. The Olympic system wants to jump to fast conclusions like hey, is that something I should go hunt, I need to go after it, or that's the line, I need to go run away. Like it needs to make these fast automatic decisions. But just because we have those fast automatic decisions that are helpful, sometimes they get in the way because the actual truth is much more nuanced and gray. So we sometimes overgeneralize from oh, this one B means I'm always going to get a B or mental filter like, oh, yeah, I know I got all A's in high school, but like those don't count for whatever reason because high school was easy. Okay. Like you're just arbitrarily deciding what information is irrelevant in a way that makes it unhelpful. Oh, that's also disqualifying. That's disqualifying the positive. The mental filter is not even thinking about those things at all. There are also many unhelpful behaviors that we can get stuck in. At the heart of them all though, I think is about the trying to avoid the feelings of anxiety. So like procrastination is, well you start working on this big paper but you're like, oh, I don't know if this is if I can finish this in time or like I don't think this is good or I don't even know, even if I did well in the paper, if I could do well in the class and your brain is like, ah, that feel uncomfortable. Let's just go watch Netflix. And you're like, oh great, and you don't have this experience of deleting the exam? No. It's just the studying. As you're starting to think about the studying, your heart rate starts going up and the insula starts noticing that. And it sends that information to the Migdla and migos like, oh my god, we need to take evasive action. So you're like, oh, let me just go watch Netflix. So you don't have a conscious awareness necessarily that you're procrastinating. Sometimes we have aggression and hostility towards other people because like, I can't control the \*\*\*\* that happens to me, but I can be an \*\*\*\*\*\*\* to you. Isolation is sometimes like, well, the discomfort of social rejection. I don't want to experience that. Ah, well, you know, what I could do is just play video games by myself and not try and make any friends. And they don't have to experience the pain of social rejection. Boom, easy. The problem is when these problematic behaviors are not intentional and they actually make the problem worse. This FMI study showed that cognitive behavioral therapy, in this case social anxiety works because it reduces the Amigdlas reactivity. So this is just showing the bold by the way, is just blood oxygenation level dependent signal. Fmri is looking at blood flow, so it's looking at the magnetic properties of blood and deoxygenated blood. That's what we're looking at when we're looking at FMRI. And we can see, oh, what's the amount of signal change, how active these regions are, How much change in anxiety do they have from before and after treatment? With psychotherapy, I mean with connive behavior therapy of many weeks, one to two months of treatment online. And in this case they also the test that they were doing inside the FMRI machine was emotional facial expressions. They just sort of like we talked about previously, they showed emotional facial expressions, and the Migdal has automatic reactivity of that. But if you rewire your brain a little bit with some cognitive behavioral therapy, and you flash up these emotional and facial depressions, well, to the extent that the anxiety, the therapy was helpful, that corresponds to a reduction how reactive your amygdala is. And I say this because a lot of times sometimes we're like we can just talking to someone about my problems that's not going to fix the problems. But sometimes I can just change how reactive your mid is. And so then the problems don't seem so big and they are easier to manage. So. One of the things we talked about last time was how uncertainty increases reactivity of the migdal. That's just how it works. But how we mentally reframe or think about uncertainty and the potential consequences can help us modulate that. So in this particular study, participants were given a series of chances to gamble. They did this because when people lose money, they tend to become more anxious about losing more money. They come what's called loss of verse, uh, meaning they're less likely to take a risky gamble the next time unless they are successful at regulating their emotions, in which case they can still take risks. Why is that helpful? Like well, in your life, you may have taken a risk by asking someone out on a date and then they said no. And if you just let your emotions run away from you, you'd be like, great, I'm just going to be alone for the rest of my life. And I'll just, that's okay. I can have my video games instead if you're like, oh, that was uncomfortable. But like, oh, that was just one time like, okay, let me ask someone else out. You don't have to avoid that behavior. You can not unnecessary risks, but just making those gambles that will pay off in the long term. Or like applying for a job, I didn't get it well, you still want to take those good gambles. In this case, they defined, some people were successfully able to do that and they called them regulators because they were succesfullyble to regulate their emotions and others weren't as good at that. They just define this behaviorally because they had them, people do the experiment. And one phase of it, they said, okay, now try and regulate your emotions. So like if you lose, just tell yourself a it's okay. So some people can do that well and some people can't do that well. And then they asked the participants to try either that mental strategy of regulating or just like just attending is what they call. They're just like, okay, just don't try and regulate anything. Just pay attention to the gamble that you're about to make right now. Whereas when they asked them to take a regulate strategy, they were asked to consider each gamble that they were going to make within the greater context like yeah, you're going to make a bet right now, you might win, you might lose. You have a total uncertainty about that. But like, hey, this is just one of many bets you're going to ask like, oh, I don't know if this person is going to go out with me or not. I don't know if I'm gonna get this job, but like, oh, this is just a small piece of all the big things that I'm doing in that puts it in context. What they found. This is a complicated graph, but this shows that the blood flow changes between conditions. In the Amigdola FMRI is always looking at the difference between two conditions. It's not looking at like the total activity. What they found like one thing that stands out when like after people lose and they compare, condition minus the regulate attend is just like, oh, just just keep doing it and regulate. It's like oh, try and regulate your emotions well. The non regulators, the people who weren't good at regulating this number here is close to zero. Why? Because regardless of what strategy they were doing, if you subtract what their midea is doing during the attend condition versus the regulate condition, Migdal is basically doing the same thing the whole time. And that's why this number is close to zero. Whereas the people who are good at regulating their emotions, if you look at this, is regulate after a loss minus attend after a loss. Well, this number is negative. Why? Well, because the amidla is really reactive when they're just doing the attended strategy. And it's less reactive when they're doing the regulate strategy. And so when you subtract one from the other, you have a negative number. Both of these people were basically good at keeping their mid check when they won money. But this is just showing that some people are better at successfully being able to regulate their midol in response to losses. This is mediated this cognitive reappraisal, this ability to be successful in your cognitive reappraisal is mediated by what's happening in the dorsilateral prefrontal cortex. So what they showed here is that Uh, when you are asked to regulate and just say, hey, just put this in context, don't just focus on this one loss that activates the dorsilateral prefrontal cortex. So there are many different forms of cognitive reappraisal, but essentially they're activating the dortilateral prefrontal cortex to try and regulate the Mgal. And if you practice that over time, or perhaps do therapy, you can get better at that so your media isn't so reactive. Another thing that can help us make better sense of the situation and feel better about it is something called a placebo. A placebo is a, a pill that you take. You can get a placebo injection or like a pill that you take that doesn't actually have any medication in it. But someone's like, hey, you should take this pill, it'll help you, but it's really just a sugar pill. In order for a medication to be approved by FDA, it can't just show that it helps people. It has to show that it helps people better than just taking a pill that doesn't do anything. Why? Because taking a pill that doesn't do anything, I mean, doesn't have any active medication in it, is surprisingly effective for some disorders like depression and anxiety. So, so this is looking at blinded and unblinded studies. A blinded study is where you don't know what medication you're, the researchers might not either. So you don't know, I could be taking a placebo or I could be taking this drug that has Zoloft in it or whatever. They Well, if you're taking antidepressant and you know for certain that you're taking antipressant, it works in about 55% of the people. And if you're taking that antidepressant, you don't know for certain you're taking it well. It works a little bit less, but it still is pretty effective. We can compare this combination therapy, which is like taking antidepressant medication plus therapy or just like a wait list. A wait list and just say, well, I'll just wait it out and oh yeah, we'll bring you into the study in a few months. Like that's not very effective. Only, you know, 11% of the people got better. But if you compare this to the people who got placebo, like yeah, it's nice that this medication or psychotherapy helps 50% of the people or whatever. But for the people who just got placebo, they just took a sugar pill. They were told, hey, this could be a placebo, it could be a real medication. You don't know? Well, I don't know, 38% of those people got better. And that's great news if you're someone who's trying to help yourself because just by taking certain actions that you believe will help you help your brain help yourself. This is bad news for drug companies who have to prove that their drug specific medication is better than placebo, but that's something else to worry about for them. But the important thing about the placebo effect is that it is a real effect. That's why it's the placebo effect, not the placebo non effect. These people did improve in their symptoms or the placebo can make you feel better or accomplish a lot of things. It's just that the mechanism behind why it works has nothing to do with the specific chemicals that are in the pill. It is the action of taking the pill that changes what your brain does or your beliefs around the situation. So placebo helps your brain create that effect on its own. And sometimes that's possible to do, sometimes you need external chemicals. But there's this cool study where they showed that it can be really helpful in pain. So they took two people, two groups of people, and they administered a series of electric shocks. But for one of them, they figured they were trying to like really amplify the placebo effect. So they gave some of them this pain relieving cream that was really sunscreen, but they told him it was pain relieving cream. And to like drive the point home further, they'd like turned down the electric shocks when they got the cream. So they'd go, oh wow, it really works. And then they brought them back the next day and gave half of them the pain relieving cream. The sunscreen other half didn't, so it's a placebo and it doesn't actually make pain go down, but they're telling you that it does. When they did the retest, everyone got the same shocks. But some people believed that they had pain leaving cream and they experienced less pain. The placebo cream, even though it didn't do anything, reduced their experience of pain. And this is just showing the power of placebos. Interestingly, if block endorphins. With a chemical called Noloxone. Well, then that effect went away. So basically the placebo got the brain to produce its own endorphins which helped block pain. Because you're like, oh, well I'm getting this pain relieving cream. And it seemed to work yesterday, so this must be really be pain relieving cream. And so you're getting the same shocks, but your brain is suppressing them and so it doesn't feel as painful. Noloxone, by the way, I believe the chemical that's in Narcan, this is like the nasal spray that you can give someone who's getting an opioid overdose. Why? Because it blocks opioids. It's a great thing to do if you're overdosing dpiates. Whereas, if you do it, and it can also block the effects of endorphins. This is because placebo is a separate study that showed that taking placebo, the region of the brain stem way deep down in the brain called the periaqueductal gray. It's gray because it's gray matter. It's periaqueductal because it's near the spinal fluid aqueduct that carries the spinal fluid. But this region of the brain stem produces endorphins and taking placebos activates this brain stem region. And interestingly, it also increases dorsolateral prefontal cortex activity. So one way to increase the dorsilateral prefontal cortex to reduce your emotional reactivity or reduce your pain is through cognitive reappraisal. And be like, oh, yeah, it's kind of painful, but I'll be fine. Like, it's not that dangerous. Okay. That might help reduce the pain. Or you could take a placebo, take a pill like, oh, this pill or this cream. Oh, that's going to help. That also activates the dorsilateral prefontal cortex and also influences these deeper brain regions. Uh, and one of the super cool things is that placebos can work even if you know they are placebos. So a lot of times people think like, oh, well the Pbo only works because you're trick, you're lying to someone, you're saying this is going to work or not. But the actual act of taking a pill helps. Why? Probably, I mean, for a variety of reasons. One is just because it's an action that you can take and that gives you a greater sense of control over the situation. Part of it is probably also related to, well, you've taken many pills in your life. Like you've had a headache and you took Tylenol and that worked. So you have this positive association with taking pills that they help. Therefore, when you take a pill your hippocampus is like, oh yeah, this is familiar to all those other situations, we've taken pills and this probably will help even if you're like, hey, that doesn't have any active medication in it. In this particular study, they took people with irritable bowel syndrome. So they had a lot of gastrointestinal issues, which are tightly tied to how active your stress response is. They said, hey, these are placebos, they don't have any active medication in it. But they truthfully said, as they showed in one of the previous slides, placebos have been shown in rigorous clinical testing to produce significant mind body self healing processes, which is true. It just, they trigger the brain to do that on its own. And they found that giving someone a pill and be like, hey, this is a placebo helped them a lot more than not treating them at all, even though the people knew that it was a placebo. Which just shows the point that like taking a specific action, a specific intention and belief changes the way your brain perceives the world. And so sometimes we're like, I don't let myself do anything because I'm not certain it's gonna work well. Yeah, go for a run or like something that I do sometimes when I'm getting a cold, I drink one of those like green machine juices and people are like, oh so does that work? Is that what should I do when I take a cold? Like I'm just doing it for a placebo effect and people kind of laugh. It's like, well no, I don't know. It's like costs $5 and it's like green doesn't taste that good. It's like got some stuff like I'm willing to believe that it will help me and it does help me. It's just, oh, I know that the way that is helping me, the mechanism that is helping me, is because helping my brain to help itself. And so there are many strategies that we can use to modulate the Olympic system by utilizing a lot of these things that we've talked about. Focusing on the things that we can control or what's uncertain, or what is actually important in our lives. And where deepted values are happy to talk about more of them, but now you understand the theoretical basis for why they're working. So yeah, thank you, and I hope you can utilize those in your lives.

# Week 4 lecture 1

Okay, science. Okay, welcome back. Today we're, let me just make sure I'm recording this. They hit records. Yep. Today we're going to be focusing on habits. We had an intro to how your brain works. We talked about stress and some of the straightforward ways that you can use your body to reduce stress in the reactivity of these emotional circuits and change how these various brain regions are communicating with each other. And last week we talked about some simple mindset changes or psychological factors that influence your stress and the communication in these various regions. And keep in mind that stress is sometimes really beneficial, It's essential to our survival. It also, if we think about that Yerkes Dodson curve, that inverted U shaped function, well, not enough stress means that we make stupid mistakes. And then as we get a little bit more stressed and excited and focused and good nervous, it gets us in that optimal zone of performance book, athletic performance, cognitive performance, enjoyment, all of that. And if we just go a little bit too much in our stress, then it pushes us out of that optimal zone, and that's when we start thinking of stress as getting in our way. But as with black or white thinking, the thinking of stress as either entirely good or entirely bad is unhelpful because it means we sometimes get in our own way. This week we're going to be talking about habits. How habits work in the brain, what function they serve, and how you can change your habits, because that's something I imagine a lot of you are interested in. This brings me to the first slide of something probably that caused me to get into neuro science in the first place. It's just sort of wondering this question of why we sometimes do things that we don't want to do. It's really frustrating because Have any of you experienced this before? Raise your hand? A lot of people like, I want to do this but then I end up doing this and it's really confusing because you're like, I'm thank you. I thought you had a question. Just slow on the. It's really frustrating because you're like, I'm a smart person. Like I got into UCLA. Like whether or not you want to accept or admit you're a smart person. Like you have to have a minimal level of intelligence, at least to get into UCLA and you're hard working. You did well in high school. You can buckle down and study, right? Like you have the ability to focus and have willpower. And then just this other stuff comes along and you're just watch Binge, watching Netflix or Tiktok, you know, until 02:00 A.M. Like, oops, I meant to be studying, so why is that? Well, it has to do with how your brain is organized and that different parts of your brain want different things. One silly little example that I experienced, I think this was after I was already getting a Phd in neuroscience. So I was like really familiar with how the brain worked. And I remember one time I was driving my car, I had actually bought my Volvo sedan from my parents. So I think at this point it is about 15 years old. Did I do want to point out as a Volvo sedan because for some reason that to me felt infinitely cooler than a Volvo station Wagon. I got in the car and I reached to put on my seat belts. And this is to illustrate a seat belt. And it went and it made this like weird sound and it wouldn't pull the rest of the way out. And I tried to like gently nudge it 'cause that sometimes works on some cars and it didn't work. And I was like, well, that's unfortunate. But I was glad I only had a short way to drive. So I turn the car on, put it in reverse to back out of the driveway. I noticed, oh, my seat belts not on. I reached back to pull on my seat belt and k, I was like, oh, right, like we literally just went through and so I pulled out onto the road and started driving and something fell off the oh, my seat belts not here. I reached back. To pull on the seat belt and and like literally every 30 seconds when I stopped at a stop sign or a stop flight, it was fortunately a very short drive. I like kept reaching back and I was laughing at myself 'cause like I know that this is not accomplishing what I'm trying to accomplish. But the part of my brain that was controlling that action didn't care. It just was triggered by like, oh, I'm not wearing a seat belt. Oh, I need to reach back and pull on that seat belt. And this is very confusing sometimes because you're a smart, rational person and you think that most of your decisions and your actions are intentional. But it's not true. Most of them are goal oriented, like they're trying to accomplish something in particular, but you're not making an intentional choice to do that. I just want to unpack that a little bit more. This is because, yes, you have this thoughtful, rational prefrontal cortex, but that's just like sitting on the surface, deeper brain regions that have been around for tens of millions of years longer, that control most of your actions and your decisions and your attention and you're just blissfully unaware of it. Like normally, you never even think about putting your seatbelt on yet. Your brain keeps you safe just doing it automatically. And you do thousands of things every day that you don't even think consciously about. You just do them automatically and they keep you safe and productive in all of these things. And just occasionally they're at conflicts with the sort of the other goals. And then we're like, why do I do this? It's like, Leah, most of what you do is that, that is how the human brain works. So this sets up a distinction that there are two sort of primary reasons that we do something. Or a fancy way of saying that motivations for your behaviors, they are either goal directed, meaning that you're trying to accomplish something specific. And that we know that they are goal directed because they are affected by how desirable the goal is. And they are flexible in that if your desire for the goal changes well, then you don't have as much motivation to do the thing. And this is in contrast with stimulus driven behavior. Which are actions or behaviors that you take simply because they were triggered. And this is sort of like Pavlov's dogs experiments like oh, just like there's a bell that rings or a light that goes out and you just like press this button or do this thing and it just is a stimulus response action. To give you an example, like a goal directed behavior. And these goals that I'm talking about aren't necessarily like big goals like oh, I want to get an A in the class. They can be really small goals like, oh, I want to eat lunch. Why do you eat lunch? Well, presumably because you're hungry, right? So normally, well, this class goes till 12, 20. So let's say you have lunch at 12:30 You're like, oh, I haven't eaten for a while. I'm getting kind of hungry and you know, walk to Ackerman or wherever and it smells good and you're like, oh, like I have a strong desire to eat lunch because I am hungry. And I know that eating food, we'll get rid of this feeling of hunger and I'll feel good and it'll be enjoyable. Now if I handed out snacks during this class, I'm not going too, sorry to get your expectations up, but if I gave you guys all a free meal during this class, you ate food. Well, you get out of this class and maybe normally you eat lunch after the class. But now you're not hungry, right? So your desire to eat lunch has gone down. It's the desire for the goal to eat Food is flexible based on how hungry you are. And if you've just eaten food and you're not hungry, then you say, oh, I'm going to, instead of walking to Ackerman to get lunch, I'm going to go to library and study. So that's a flexible behavior based on the desirability of that goal. Or, you know, maybe normally at a party when you're single, you're just like, oh, trying to get everyone's digits or, you know, hook up with people, whatever. And that's wonderful. More power to you until the point where like, oh, you're in a relationship. And you're like, oh, I'm going to change my behavior because the desirability of finding a boyfriend or girlfriend has decreased because I've already found one. Or maybe it increases because now you feel constrained and out of control. I don't know. But the point is that it is flexible. Your desire, your motivation to do it depends on how desirable the goal is. Whereas the stimulus driven behavior is, you do it simply because it is programmed into your brain in this stimulus response way. That doesn't mean that it can't be retrained at some point over time. But you just do it because it has been triggered. So sometimes we eat lunch because we're super hungry. Sometimes we eat lunch simply because, well, every day after this class or on Mondays and Wednesdays, I leave this class, I walk over to Panda Express, I stand in the ridiculously long line, I order orange chicken, and you're just doing it, not because you're hungry. And if someone like, you know, interrupted is like, hey, are you actually hungry? Oh, I think so. I'm not sure like you're just doing it because that's what you do when you walk out of this class. I'll give another example of like, if you've ever had this experience where a light bulb like burns out in, in your bathroom. Well, we've probably all had this experience before. Like you walked into the bathroom and, you know, go to flick on the light switch and it just doesn't turn on. You're like, oh, okay, similar to this seat belt analogy that I gave. Well, probably the very next time that you walk into that bathroom, you reach out and you hit the light switch and it doesn't come on. Like you know that it's burnt out. But all your brain is doing is acting on the stimulus of walking into a dark bathroom and reaching for the light switch. And you had to learn that association for your specific bathroom. Like when you first moved into your apartment, you walked into the bathroom, you didn't know where the light switch was. It could be over by the toilet, It could be right on the left. On the right. It seems like they should standardize these things because so you don't have to fumble around, but like you just walked in, you fumbled around, oh, you found it. You flicked on the light switch, Oh, it worked. And that you knew that worked because the light came on and your brain's like, oh, okay, I guess if I want to turn the light on, then I should do this. And therefore, in the beginning it was goal oriented because you're like, it's dark. I want to say let there be lights and just you search around until you've found the light switch. But at some point it gets practiced enough and wired into your brain where it becomes stimulus driven. Where you walk into the bathroom, you don't even think about where the switch is, you just hit it and, and that just behavior happens automatically and unconsciously. And it's inflexible, meaning that even if you know that the light bulb is out, you still walk into the bathroom and oh, right, light bulb is out over time, you know, you might learn, okay, that light bulb is out. Or maybe over time you would get frustrated and change your light bulb. But the point is that you are doing that behavior even though you know that it's not accomplishing any specific goal. Because it's controlled by a different part of the brain. The dopamine system is important in all of these types of behaviors. I just wanted to to sort of illustrate how these map on to different brain regions. So the easiest to understand are these sort of intentional, willful actions that we take. That our goal oriented towards some bigger goal. Like oh, I want to go on vacation with my friends, okay? So then I'm going to go and look up flights and hotels and whatever like. Okay, You're taking action because you're excited about going on a trip with your friends. And if you aren't friends with them anymore or you don't like them now, then you're less excited. It's flexible based on the desirability of the goal. And then again, that can be big things like I want to get into medical school or small things like I want to find somewhere to eat lunch. And these sorts of goal directed behaviors that are, that we carry out in an intentional sort of analytical or strategic way are mediated by the prefrontal cortex, where you're like, oh, maybe like I'm not that hungry right now, but I know I have. 4 hours of class right after this. Okay. So I'm going to eat lunch. Where should I go eat lunch? Oh, I could walk all the way up to Ackerman. Oh, that's out of the way. Okay, I'll just run over to Med Cafe. Like, okay, we can think rationally through these things and decide what we're going to do in an intentional way. But that's not the only way that we accomplish our goals or that we make goal directed actions. This is also mediated by the nucleus acumbents. It's just that the nuclear acumbents, the goals that the nuclear acumbents wants us to do are the things that are most immediately pleasurable or the most immediately controllable or that'll most immediately get us out of danger. And sometimes these things are competing with each other, right? Like, well, I know I have to study for the exam and I also need to eat lunch. And so maybe your prefrontal cortex is like, hey, I want to keep studying and your new coming is like, oh, but it'll be so much more enjoyable to eat lunch. And as you get hungrier and hungrier and hungrier, well the desirability of eating lunch becomes more and more and more and then at some point the nucleus accumbens wins out. It's still a goal directed behavior, It's just that studying is maybe like a long term goal. And like eating lunch is a short term goal that is driven by how hungry you are at the moment. These are both examples of goal directed behavior. It's the previnal cortex is more involved in the intentional, thoughtful, goal directed behavior. And the nucleus deucumbans is involved in the impulsive goal directed behavior. And the reason why I put the nucleus decumbents and the dorsal stratum in red is because they're both part of the same stratum structure. I wish it was simpler to say like, oh, all goal oriented actions are the pre fundal cortex. But it's not, there are different kinds of goal oriented actions. But what is simple about it is that the stimulus driven behaviors are exist in the connections within the dorsal stratum, this part of the brain that acts on a stimulus response level. That you are doing something simply because this is what you do in this situation or this is what you've practiced over and over again in this situation. That gets wired more strongly into the dorsal striatum. So now, whenever this situation occurs, it just triggers that action. Oh, every time I walk into my bathroom, I reach and go to the left or every time I sit in the car, I reach back and pull on, put on my seat belt. And so anytime that is triggered, the dots stratum does the action and sometimes it gets in the way because it's trying to pull us towards these things that we just do automatically. And that might be at odds with what we are trying to do intentionally. This can exist in a whole variety of domains in your life. These can be simple behaviors like I've been talking about, like putting under seatbelt. They're flicking on a light switch. They can be cognitive habits. Any time you're going into a new environment, you just have habitual thoughts of like, oh, I don't think I'm going to like this or like, oh, this is fun, I don't know. Like we can train different cognitive habits. We can have different social and emotional habits. Like when you are talking with someone, or you're talking with a professor, or your boss, or someone with authority or power over you. Oh, we can have different emotional reactions and different ways we interact that are automatic. And triggered differently than how we are with our friends or like in different environments, like how you are in class, might be different than how you are at a party. You don't need. Now at this moment, I'm guessing to suppress your urge to dance or to flirt with people. Maybe some of you might have more issues suppressing that at the moment. But like, you probably don't need to suppress your urge. Dance because you have no urge to dance right now. The context is not triggering dancing, and there's no music other than the melodious sounds of my voice, this is a joke. There's no music If you're not in a place where other people are dancing and there's no music, it is not being activated by the dorsal stratum and therefore the motivation to do it. This is really helpful to understand because sometimes we're like, why can't I just study? Why can't I, Why do I keep watching TV instead of studying? Oh, maybe it's because you're sitting in your apartment, in front of your TV with your remote control sitting next to you. And now, oh, that action is being triggered all the time. And the whole time you're trying to study your dorsal stratum is like, hey, but what if we just watch TV? Let's just reach out. Oh, the remote control is already in your hand. What if you just press oh, what's on Essex? Oh, that's top ten today. Oh, that's interesting. And like all of this happens outside of your conscious awareness. And it's going against your intentional desire to study. Like, I don't know what's wrong. Why do I have to suppress this urge to watch TV all the time? Well, because it's being triggered and sometimes the solution is recognizing. Yeah, that's just what the dorsal stratum does. And then changing it in ways so that we don't trigger it the same way. Or retrain it so that it doesn't respond to those triggers in the same way. I've talked about this slide before, but since we're going deeper into habits and impulses today, I just wanted to reiterate this. The, the goal directed behaviors that are mediated by the nucleus acumbins, we would call impulses. They're goal directed behaviors, but we colloquially call them impulsive because the goal is about short term gain. We might have long term goals and we need willpower for, but they're both goals. The impulsive behaviors that we do are mediated by dopamine release primarily in the nucleus acumbs, So dopamine is released in the nucleus commons for a variety of reasons. The biggest one actually is novelty or new things. Those direct our attention and behaviors more than things that we are very familiar with. So like if you walked into your apartment and you saw a package sitting on a table they hadn't seen before, well, you'd probably notice that and you'd walk over and look at it. Whereas, if it was just your regular table, you wouldn't have any conscious awareness, you wouldn't have interacted with it. T the same old thing you can safely ignore. This is why sometimes in a relationship when you're really familiar with someone, oh, it can get kind of boring or stale. And then, oh, these new cute faces that you see at a part, oh, do sun become really exciting and you're releasing more dopamine to these new people that you haven't met before. Just because new things stimulate more dopamine in the nucleus acumbens. It's why companies will change their packaging, change the color, and that can influence your behavior. And hadn't seen this variety of M and M's before? Let me buy this because if it was the same old M and L, you ignore it and you stop releasing as much dopamine. When things become very familiar, we release dopamine when something is unexpectedly rewarding. When you try a new candy bar, you meet a new person or whatever. It's like, oh, oh, that was more fun than I anticipated. And that's essentially your brain trying to get you to do that, just like, oh, that was good. Do we also release dopamine to try and anticipate those kind of rewards? Again, your brain wants to try and get the stuff as it wants as efficiently as possible. If there are predictors of when you're going to get that reward, then your brain wants to take the actions that then we'll get you the reward. Um, when you drive past Ralph's or you walk past Ralph's and then you're like, oh, right, there's a candy aisle and Ralph's. And then that starts to become rewarding in and of itself to just walk in to Ralph's. Because your brain is releasing a little bit of dopamine in anticipation of you going down the candy aisle and picking out a piece of candy. And each time you take that action, it gives you a little boost of dopamine, which then propels you to take further action to keep getting those rewards. And at any point you like your prefrontal cortex wanted to intervene and like, no, I'm not going to get a candy bar. Well, it's capable of doing that, but you need a reason that supersedes that. Like, oh, I don't have enough money for a candy bar and, you know, cereal or like, oh, I have to make a choice or like, oh, I'm getting cavities. You're like, oh, you know, my blood sugar is out of whack or whatever. So it's possible to have other goals that supersede that. But that's sort of how the nucleus acumbens works. It reacts to novelty. It draws our attention and our awareness to new things, to things that are unexpectedly rewarding. And then it tries to push us towards things that we know will be more immediately rewarding. There's this interesting relationship between stress and impulsive choices. This particular study was an FMRI study, again looking at blood flow changes, comparing two very similar conditions. They recruited people who said that they were trying to maintain a healthy lifestyle in terms of diet and exercise, but who in some way that they were still eating more junk food than they wanted. And they often felt like they didn't have enough self control. They took these people, they brought them inside. An FMRI study had them play this game where healthier foods or two different foods presented. And sometimes one of the foods, it could have been in the left or the right was healthier than the other. And sometimes it was a lot healthier, sometimes it was a little bit healthier. And they also, before they had participants do this, they asked them about their preferences for the food. So they said, how much do you like ice cream? How much do you like pizza? How much do you like grapes? How much do you like apple juice? Like they just had, you know, you could rate, everyone has a different preference for these different things. How much do you like sushi, whatever Like we all have different ratings. So they would present them these two different foods that had different health, health conscious associations with them. Most of the time, there was a little white box that highlighted the food. And the flash up on the screen, you just have to click as fast as possible. Flash up on the screen, click as fast as possible. The thing that made it tricky though is that sometimes the white box highlighted the food that was healthier. You had to, oh, realize op, there's, you know, an apple and ice cream. Op, the white box is around the ice cream. And you had to inhibit the impulse to just click on the white box as fast as possible. Because it's like, oh, oh, that's not actually healthy. And it took a little bit of processing to think about what was healthier. So you're trying to go as fast as possible to select the unhealthier option. And sometimes you have to inhibit that impulse to just click on the white box in order to select the healthier option. And then they added this other condition where sometimes the people were stressed out and sometimes they were just in their normal, moderately stressed state, whatever state you're in right now. But to stress them out extra, they had them stick their hand in a bucket of ice water because pain is a really good way to activate the stress response. And what they found was that biases you towards taking impulsive actions. It amplifies the dopamine in the nucleus. Sucumbents graph shows, first of all it's going, starting from zero. That's important when we're looking at a graph. This is showing the probability of self control failure, meaning you were supposed to select the healthier option as fast as possible. But sometimes you made a mistake. One of the first things that we can notice is that the blue dots are lower over the whole range that we're talking about. Then the red dots, the blue dots are control. The red dots are the stress. And this just means, well, you're more likely to make a mistake and impulsively pick the wrong thing when you are stressed. Another takeaway comes from the interpretation of what this taste difference level means. You rated on a scale of one to six, how tasty, whatever the food was for you. You did this before the experiment. So the experimenters, no. Oh, you love ice cream and you really don't like celery. Okay, well, if we present those two things to you, those have a big taste difference level of say, five. Whereas other, other things like, well, I kind of like potato chips and french fries, maybe one of 31 of four. So like those have a really small difference in how, how much preference I have from one or the other. So that means things that are really desirable should activate my nuclear incumbents more. And therefore, it takes more effort to override that, to say, no, no, I'm just supposed to choose a healthier option. And when we are stressed, we just get not as good at doing that if the taste difference level is like close to each other. Like oh, I'm trying to choose between apples or apple sauce. Okay. Maybe apple is a little bit healthier than apple sauce, but like, oh, I kind of like them the same. Like it's easier to make the correct healthier choice when one isn't pulling you so strongly because of its desirability. But when you're stressed out and something is really desirable, even though, you know, it's not what I'm supposed to be doing here, right? You know, or what my overall goal is. Well then the nucleus acumbens will automatically sort of guide your actions towards that impulsive behavior. So stress biases you to make more impulsive decisions. We talked about this before, that stress and we talked about the Yorkies Dodson curve, that optimal level of stress helps the prefrontal cortex function optimally. But too much stress disrupts the proper function of the prefrontal cortex so that it can't regulate these other regions. So that when you are stressed, these lower level regions take over and you become either more impulsive or more habitual. This is showing how the nucleus incumbents and the Migdola are both involved in this region. Here is the nucleus recumbents. It's called the nucleus sucumbents because it's recumbent. And this looks like this part is like lying down here. Anyway, that's where the nucleus sucumbans. This part over here is the midola. Just to orient you here is the insula. I think we've talked about the insula is like, oh, this little piece of cortex that comes all the way in there. It's very close to the Migdola, but it's not technically part of the Olympic system. But as stress goes up, well then we have increased the Migdal reactivity, we've increased the nucleus reactivity, and it makes us more impulsive. Now, stress also biases us away from taking goal directed action and towards stimulus driven choices. Goal directed actions could be the prefrontal cortex choosing goal direction. It could be the nuclecumbents choosing that goal directed action, or we do a stimulus driven action. That's controlled by the dorsal stratum. In this particular study, they had people stick their hand in a bucket of ice water. Sometimes it's just reliable way to stress people out, it doesn't actually cause them long term damage. On the graph here, what they showed is levels of cool primary stress hermone. They had this task that I'll describe in a moment. Before they did that, they stressed them out by having them stick their hand in a bucket of ice water for like four or 5 minutes. And as you can see, increased cortisol for one of the groups, just as they were starting to do this learning task. That's what they were trying to say is one group increased cortisol, increased stress. The other group was the control. What the learning task was is they just showed these shapes or same random shapes that were linked probabilistically to certain outcomes. You're trying to, they show you a circle in a triangle, you just have to pick one. I don't know which one should I pick. But like when you pick certain ones, then you're rewarded with chocolate milk or other ones you're rewarded with orange juice or as a control condition. They had peppermint tea, which is like, oh, it's got a flavor, but it's not as like desirable or sweet as chocolate milk or orange juice. When you first start this task, I don't know, like circle triangle. Who knows? You just pick randomly, but quickly your limbic system and these deeper regions start to realize, oh, I got a good feeling about this circle because oh, 70% of the time that you've chosen the circle before you've gotten chocolate milk. But if you choose the triangle, like you only have a 30% chance and you don't consciously remember that, you're like, oh right, of the last 50 trials that I've done, like the triangle has been positively rewarded on 33 of them and the circle has only been rewarded. And whatever, you're not consciously thinking about these things. No, but your limbic system is really sensitive to subtle statistical differences in a way that you just like have a good feeling about this. There are studies, by the way, on Dex of cards, where if you have a red deck and a blue deck of cards and you can win money or lose money from either, but just that there are more winning cards in the red deck, well, you can choose randomly and just start picking. Sometimes you win, sometimes you lose. And pretty quickly you gain a preference for one of the decks because you're like, oh, I feel lucky, this one feels lucky to me. And after about 20 rounds, you can ask people like, oh, do you like one of the decks or the other? And they're like, oh yeah, the red deck seems like it has more winning cards in it. But if you look at people's behavior, their behavior starts to change to favor that red deck, even before they're consciously aware of it. They became consciously aware of it like after 20 cards, but after like 12 cards, they just started choosing that one more. And this is really useful for our limbic system to, to pay attention to subtle statistical differences. We're like, well, this thing has a 60% chance and this thing has a 40% chance. Well, those stimulate our feelings where all of a sudden we're like, oh, this is a good one and this is the bad one. And it takes those differences and amplifies the into black or white. This is unfortunately, you know, how we sometimes think about ourselves or these are things that create problems with racism or classism or like we have these subtle statistical differences that do exist. And then they just trigger feelings that we're not consciously aware of what their origin is. We're just like, oh, that's good, I'm going to do that, oh, that's bad, I'm not going to do that. So this is taking advantage of that to learn these associations between what is rewarded, what is good, what is bad. And then So that's the learning phase where you start to figure, oh, I start to like, I really like the triangle. Feel good about this one. And then you learn all of these associations. Whether you're stress or not, you can still get good at learning these various associations. So this is just showing the probability of choosing the right reward is you get good at that, whether you're stressed or not, and the value devalued will make sense in a moment. Some of these iterations are rewarded with chocolate milk, and some of them are rewarded with orange juice. Both are the rewards scenario. But after you learn these associations, like oh, triangle is really good for chocolate milk, then you take a little break. They say, okay, you can drink as much chocolate milk as you want. It seems like you really like chocolate milk. So here, here's a pitcher of chocolate milk. Drink as much chocolate milk as you want. We're just going to take a break from the study and then we'll go on. So half the people are given chocolate milk to drink as much as they want. Half the people are given orange juice. And so what should happen is if you like something and then you are given as much of that thing as you want, well then after that point, you shouldn't want it as much, right? Like if you're kind of hungry for lunch. And then I say, well, you can go to lunch and eat as much food as you want if you eat as much food as you want. And then I say, hey, would you like to go to second lunch? Well, your desire, your motivation to go to second lunch should probably be decreased if indeed it is goal oriented. Because the desire to accomplish that goal should have gone down. So the way they're framing this here is that one of the rewards is still valued because you're like, I didn't have as much orange juice. Yeah, I still like orange juice a lot. But one of the goals has become devalued because you're given as much chocolate milk as you could drink. And what they found is that in the control condition when your normal relaxed state that you can realize, oh, I don't care about chocolate milk anymore because it's been devalued, so I'm not going to keep picking the chocolate milk. And so that's why the two rewards start to become different. They're not labeling them as chocolate milk or orange juice because it's randomized. Some people have orange juices that valued ones, some people as chocolate milk as valued. And some people have the opposite as the devalued one. But when you're in the stressed condition, you keep picking the devalued one. Let's say chocolate milk. You keep selecting chocolate milk. Even though you don't want chocolate milk, you just drink as much chocolate milk as you want. You don't want chocolate milk anymore, but you keep doing it because that is what has been trained, this is the association that's been trained in the dorsal stratum and so you keep doing it even though it's not desirable, simply because it is being triggered. And this is because habits you can kind of think of as tracks in the snow that every time, whether you ski down a hill or walk across a field of snow, whatever, like you create a track. And then the next time you come along, well, you're sort of more likely to go in that track. And over time it creates a deeper and deeper groove that is very easy to fall into. You're trudging through the snow over here. Oh, why don't you just fall into this groove? And once you're in that groove, it's very hard to get out of the way this plays out in the brain is in specific connections between neurons that you have some stimulus that then triggers some specific action, or set of actions in the dorsal stratum. And each time that pathway gets activated, well, those neural connections get stronger. This is an example of neuroplasticity at work. Neurons that fire together, wire together. Those neural grooves, in a sense, become deeper and more entrenched. I just want to point out though that, well, it's possible to create new groups. Like sometimes we're so stuck in this bad habit, I totally change this bad habit. Well, you could just create a different habit and strengthen that and reward that, and then have that become the deeper group. So that becomes more easy and automatic to fall into. And that's what we're going to focus on next time. Y questions about this. By the way, things that I've covered so far, Awesome. Awesome. Either way, whether you have questions or no questions, I'm saying awesome for myself and that I've explained it perfectly. But it is not awesome if you are not actually answering, asking the questions that you're curious about. Yes. So in the chocolate milk example, why are people likely to choose it even if they don't want it? Because the part of your brain that is making you choose it doesn't care about what you want. The prefrontal cortex that cares about what you want and sort of oh, longer term goals, the nucleus compens, that cares about what you want in terms of your immediate rewards. Oh, I want a candy bar. Oh, I want to stop listening to this lecture. Oh, I want to, whatever we have immediate impulses. The dorsal stratum, it doesn't care about what you want, It cares about doing whatever you've programmed it to do. So there's just a stimulus response. The stimulus happens, it activates this behavioral set of patterns in the dorsal stratum or emotional set of patterns, or social set of patterns. Uh, or whatever. Does that make sense? Yeah, it's very complicated to wrap your heads around because we're, but I feel like doing these, we know what it feels like to have conscious, intentional action. But different parts of your brain want different things. Yeah. A step back push. So you say taking a step back under, under stress, I think I share this action conversation where the thing that you end up doing is a conversation between your prefrontal cortex and your dorsal stratum and your nuclecumbens where the prefrontal cortex, where dorsal stratum acts first and is like, hey, let's do it this way, because this is what we always do. The prefrontal cortex is like, oh, let's not, that's why we're stuck in the same situation. Maybe we shouldn't progress, nayybe, we should do, actually study. And then the nucleus acumbens comes in, is like, hey, let's watch Netflix. In that conversation, your actions get determined when you are stressed. It biases that conversation away from the prefrontal cortex and towards the, uh, dorsal stratum and nuclear sucumbents. It doesn't bias it completely away from goal directed behavior, it just biases it away from long term goal directed behavior. Either impulsive goal directed behavior, towards, towards habitual stimulus driven behavior. If those two things had to win out, you would probably fall into stimulus driven behavior. Great questions. So I guess not awesome that you didn't ask those questions before, just keep asking questions. It really helps you understand the information better. And other people probably have the same questions and want it said in a different way. Mindfulness is one of the best ways to start rewiring some of these habits. Mindfulness, there's a lot of different definitions. One of the early researchers on mindfulness, I mean, mindfulness and meditation have been around for a long time, but it hasn't been researched rigorously until the last 30 or 40 years or so. This researcher, John Bazin, described it as paying attention in a particular way which is on purpose in the present moment and non judgmentally. Although when I was writing my workbook, I talked to one of the directors of the Mindful Awareness Resource Center here and he was like, yeah, I just don't like the non judgmental part. Maybe the goal or the end result of mindfulness meditation or mindfulness in general is to let go of some of your automatic judgments. We can't help but be automatically judgmental, like you bite into, you know, a rotten apple or like, yes, part of you is aware that you're biting the apple, but part of you is automatically, I don't like this. You cannot help but have automatic emotional reactions to things. And if you get mad at yourself for having those automatic emotional reactions, then you're just following whatever autopilot your brain has already been programmed into. The goal of mindfulness is simply to become aware. Quickly, as fast as possible. At least of those automatic emotional reactions, not because you can necessarily control them, but simply because those are things. Those are emotions that you are having in the present moment and just, oh, I'm not, I think this is a disgusting. Okay. Well, that process has many benefits. If you can become aware automatic judgments and automatic emotional reactions faster, then it's been shown to improve anxiety and stress and depression as increased well being overall, even improvements in test taking. Oftentimes when we think we're becoming aware of our emotions, what we're actually doing is temporarily becoming aware of our emotions and then falling back into old patterns. A lot of times when people start practicing mindfulness, they're like, okay, like The goal of mindfulness is simply to direct your attention on purpose, to some specific thing in the present moment so you can focus on your breathing or music, or looking at a candle or whatever. You're just directing your attention to some specific thing. Because you are human, you will get distracted either by a thought or by an emotion. And what often happens if we're not being mindful is we get distracted and then we just, you know, follow the butterfly of our thoughts for wherever it goes for 10 minutes and then we're like, oh wait, what was I supposed to be doing again? All right. I was supposed to be paying attention to this thing. Sometimes we'll get distracted by emotion and we're like, oh, I'm feeling bored right now. And to be mindful, all you need to do is, oh, I'm feeling bored right now. That is literally the experience that is happening right now. But then you're like, oh, right, that's okay. I'm just going to direct my attention towards whatever I was intending to in the first place because it's intentional. What normally happens, however, is that we're like, oh, I'm bored. Why am I bored? I'm supposed to be practicing mindfulness. Oh, I'm such an idiot, I can't even focus on it. And then we just like go off on this automatic stimulus response chain of events triggered by our habits and our emotions. And it's only 15 minutes later like, wait, what was I supposed to be doing again? So mindfulness helps us stay more present by practicing being present and not being judgmental. Or at least becoming aware faster of our automatic judgments, even our automatic judgments of our own emotions. And this study found that mindful people have smaller amid that supports the hypothesis that mindfulness will help shrink your amygdala so that it doesn't have such a big pull over you. Sure, that's one theory that's supported by this evidence, but this is just what's the word I'm looking for? Why am I blanking on this term? This is triggering dreams of being, what's the word I'm looking for? Anyone? There's a correlation. Thank you. So I have practice being calm under pressure, forgetting what I'm going to say, so you don't have to worry about me too much. I would like to not forget. But anyway, that happens as you get older, correlation does not imply causation. So you can't know, is it that mindfulness makes the amigula smaller, or is it the other way in that? Oh, of course, some people have an easier job of being mindful. Those people are the ones who have less emotional reactivity. They're not distracted by these emotions, so they have an easier time of being mindful. It could be just a spurious correlation or caused by something else entirely. My guess though is that it's bidirectional, that yeah, mindfulness is helpful, but also some people have an easier time of being mindful. This particular study supports the benefits of mindfulness, that oh, if you actually practice it, will help you. In this particular study, they had people practice mindful breathing, which is essentially what you guys did last week as your intervention. And they found that mindfulness meditation reduces anxiety, even when you just practice it for a week. And though as you notice, there are some immediate effects like from pre session to post session at any given day, oh, there's a big effect. Oh, but then you sort of drift back to your baseline of how anxious you were before. So this is one of the reasons why we don't have you fill out your daily questionnaire immediately after you do your intervention. It's not that it's wrong, okay? If all of mindfulness did, which just make you feel better immediately after you did it, okay, It could still be useful. But I think what's more interesting is like, oh, but if you keep doing it, it has a sustained effect by measuring the data the next day, oh, you're better able to see, oh, is there a sustained effect or not. I think sometimes we're so focused on what has this immediate effect that we overlook what has sustained effects. This showed that there's reductions in anxiety simply by practicing mindful meditation for a week. And these are accompanied by increases in activity in a wide variety of regions, including the medial prefrontal cortex, the anterior cingulate, and the insula, the medial prefrontal cortex. That makes sense because like, oh, that's what helps us become aware of what we are doing. And so we naturally get distracted and then we're like, oh, I've been distracted. Let me redirect my attention towards what I was intending to in the first place. The anti cingulate play a big role in attention in the first place, and we are strengthening our ability to pay attention and to notice when we've been distracted. The insula is also an interesting one, and that the insula normally tells us like what's going on in our body. But often what happens is the insula sends a signal that like, oh, your stomach is hurting, or your heart is beating really fast. Then what usually happens is that triggers an emotion, anxiety or discomfort or whatever, and that triggers habits. And then we're no longer aware of our body at all all. We're not even aware of anything other than just, you know, our anxious thoughts. And we're not even thinking about our thoughts. We're thinking about the catastrophic things that could happen in the future so we're no longer present. When you practice paying attention to the present moment, then you become improve your ability to be aware of your body and what is actually happening. Now, instead of having your body just like trigger anxieties that take you on a roller coaster, wherever your brain is programmed to go. We have a lot of strategies for dealing with stress, but the ones that are really successful at dealing with stress, that are strongly programmed, sort of deep grooves in our dorsal straight are called coping habits. These are all habits are triggered by stress, but some in particular are really good at mitigating and reducing that stress. And we call those coping habits they could be socializing with other people. When you're stressed out, I just need to hang out with my friends. Sometimes they could be positive things like you know, socializing or maybe sometimes exercise. But even here, by the way, the word positive, it's not useful to think of it in black or weight because like exercise, yeah, it's generally positive and it's generally positive because most of us tend to not get enough exercise and it tends to not have negative consequences. But if you have a coping habit of exercise and you also have an eating disorder, well then that exercise habit, which helps you reduce stress, can actually cause other problems. Or if your exercise is your way of procrastinating, then you become really convincing to yourself that, oh, I'm not procrastinating, I'm just exercising because it helps me deal with stress. But this is where it's helpful to realize like habits are not good or bad, they are just things that you do that help you deal with stress. And sometimes the ways that you deal with stress also cause other problems. But it's helpful to be aware of that you often need more awareness or mindfulness in order to do that. Sometimes, by the way, we are judgmental of ourselves for having coping habits, like I'm super stressed out about this exam and so I go to DDs and have some cookies like I did. I had a habit of that when I was writing my book. I kept going to dries and. It's actually not helpful to get mad at yourself for enacting your coping habits because like, that's just what your dosaltratum is trained to do. And now, instead of whatever other stress you've also been experiencing that caused those coping habits, now you're mad at yourself and increasing your stress, which guess what, just pushes you more towards those same coping habits? This is why self compassion, it is really powerful. We'll talk about that more later. These coping habits that we fall into or can also be thought of as rituals. Right. Like, it's just like different ways of marketing those. Like if I describe something to you as a ritual, oh, I have a ritual of going to dares to help me with my stress. Oh, that's a good thing. It's good. You have rituals. Well, like whether you call it a ritual or superstition, or a bad habit, like it's all the same thing. It's all driven by what's programmed into Rs Stratum. Sir, if you want to call it something bad, go for it. But does that help you change it? If not, well then it's probably not helpful to think of it as bad. So a lot of superstitions or just ceremonies that we fall into that we've practiced for a long time, they comfort, it's just that sometimes they comfort us and they also help solve the problem. Like exercise might be a good coping habit for stress. But it's also often good because in the long run it will also decrease stress. So it decreases stress in the short term because it's a coping habit. And it decreases stress in the long term because it's generally a good coping habit. Sometimes our coping habits only decrease stress in the short term. And they're kind of neutral in the long term. Like oh, I have a habit of, I don't know, doing the crossword puzzle when I wake up. Okay. It's a kind of helps me feel calm in the morning. It doesn't have any long term positive or negative effect where sometimes, unfortunately, the coping habits that we fall into, like, you know, eating, going to dries too many times, or drinking alcohol, they really help us in the short term deal with stress. But in the long term they actually create more problems, that create more stress. And then when we're stressed, it will push us back into those coping habits, and that's when it becomes a downward spiral. So you shouldn't get mad at yourself. That doesn't mean you won't get mad at yourself. But it's helpful to be mindful of your self criticism to realize like, oh, I'm mad that I keep going to dries instead of writing my book. Oh, well what should I do there? I have the opportunity, once I become aware of the fact that I'm mad, I become aware, oh, that this is being driven by stress. Then I can intentionally choose perhaps a better way to deal with that stress. This study also having people stick their hand in a bucket of ice water, showed that pain as a stand in for all stress in general causes dopamine release in the dorsal stratum, it just activates the dorsal stratum. When the dorsal stratum is activated by that dopamine release, it pulls you into whatever your deepest, most ingrained coping habits are. We'll talk about this graphic next time, but this is from a great book called The Power of Habit, which he doesn't talk about the brain at all, but it's just a good job of summarizing how our habits work. And we can see how it maps onto the brain region, specifically the dorsal stratum. All habits have the same structure. We call them good habits or bad habits. They all have the same structure in that they are triggered by something. There's a E that causes us to do some routine, either a behavioral set of actions or a particular way of thinking. Or sometimes multiple. Because one habit can trigger another habit, trigger another habit, and so on. But there's a causes us to do something or think something or feel something, and then that is rewarded because it benefits us in some way. All habits benefit you. In some way. And one of the really unhelpful things that we do is that we do a habit. And then we criticize ourselves for having a bad habit, probably because we've created a habit of self criticism. And then we criticize ourselves for having a habit of self criticism. And we're like questioning, why am I doing this so stupid of me, I'm such an idiot. What's wrong with me? This is clearly not useful at all. Well, one thing that I want to reassure you is that if you have a habit, it is helping you in some way. So it's not generally helpful to just criticize yourself for helping yourself. But why do you have that separate habit of self criticism? Oh, well that also helps you. How does that help you? Well, if you can try and figure out how a habit actually helps you, then you can have a sign or an insight into how you could potentially change it. Habits of self criticism, by the way, often help us feel more in control. They give us a perceived sense of control over situations that we may not have control over. And having that increased perception of control makes us feel good. Oh, that gets rewarded because it calms us down, because we feel more in control and because it's rewarded and reinforced those neurons get strengthened, those connections get strengthened the roto stratum. Which means that the next time that happens, oh, you made a mistake, oh, someone said something rude to you, whatever, then it's going to trigger that same habit. That same habit's gonna benefit you in a similar way and then it's gonna get reinforced. Unfortunately, the more that this happens, the more things get strongly wired in the dorsal stratum and sometimes we do things simply because that's what we've done before. If we do things that we've done before and we activate our habits, then it reduces stress in the short term. We do them because it is helpful. But then we get stuck in a pattern because it can have unfortunate, sometimes long term consequences. This idea of reinforcement, of reinforcing particular behaviors is related to our understanding of addiction. And addiction and habits are very much overlapping. Scientists have studied reinforcement in different ways. You can take rats and you give them a lever. And they can press the lever for getting sugar, water or cocaine or whatever. And there are different ways to reinforce the behavior. If you want to get the rat to press the lever at, the essence of behavior is simplified down to you like, okay, you just want to do this thing Well, they can reinforce that in a variety of ways. Let's say every time the rat presses the lever, it gets a reward. So that's a fixed ratio. It's a fixed one to one ratio. You do this behavior, you get a reward one to one. You could also have a fixed ratio, that's not one to one. You say, oh, you got to press this lever five times and then you get a reward. Or you press the lever ten times and then you get a reward. Those are all fixed ratios. The interesting thing about fixed ratios is then when you stop rewarding the behavior, then the rat quickly stops doing the behavior. It's like for your job, I could have you stack boxes and I say, well, you got a stack 100 boxes and I'll pay you 20 bucks, okay? Well, if you sack 100 boxes and then I stop paying you, then you're going to stop stacking boxes. It's like pretty straightforward. And that's how we normally think of our behavior. Oh, this behavior benefits me. I do it and it stops benefiting me, I stop doing it. But when you get into probability and you start activating emotions because things are uncertain and potentially out of our control. And you start activating the nucleus acumbents more with this uncertainty and excitement that changes things dramatically. So a variable rewards ratio is instead of saying, oh, you press this lever five times and I'll give you one reward. Well that's, you know, one reward every five times you press it. I could also, if I wanted to create a variable reinforcement ratio, say every single time you press the lever, you have a 20% chance or 1.5 chance of getting a reward in the long run. Those are the same thing, right? Like you get rewarded on average every five times. It's just that one you get rewarded exactly every five times, and the other you get rewarded on average every five times. Which means my experience of pressing the lever in a variable reinforcement is that I could press it once and get a reward and press it again and get a reward. Or it could press it like 20 times and not get a reward. So there's a lot more uncertainty. And the interesting thing about that is when you train rats on a fixed schedule. And then you say, okay, well instead of pressing it five times, now you have to press it ten times. Or now you have to press it 50 times. Now you press it 100 times to get a reward. Well, at some point they'll be like screw this, This isn't worth it. Whereas, when you have a variable ratio, and now you change it from one in five to one in ten, to one in 100. Well, they don't actually know because they're like, oh, maybe the next time, oh, is it still working? Is it, oh, maybe the very next time. Then it becomes something akin to gambling and that you could even stop reinforcing them at all and they just keep pressing the button, the pre stress and lever because they're like, oh, maybe the very next time. And this illustrates a key point about our behaviors is that sometimes we start doing behaviors because they are goal oriented. Either from our nuclear succumbins or dorsal or our prefrontal cor, tanks. And they help us a lot, but the more that we repeat them, the more they get wired into our dorsal stratum. And then we just keep doing them simply because not doing them would create stress. And when we are stressed, we want to do them because they're wired into the dorsal stratum. So in this particular study, they took FMRI scans of people who were heavy or problematic drinkers. They didn't worry about whether they classified as alcoholics or not, just like, oh, I drank a lot. And other people who were just light drinkers or social drinkers, they only, you know, drank when they were with friends. And they showed them various images as a control in the FMRI machine. And then they also showed them images of like their favorite drink or their favorite alcohol. And what they found is that the light, the people who were social drinkers, they activated their nuclear incumbents when looking at a picture of their favorite drink because it had positive associations. Like oh, hey, maybe I'll go to happy hour on Friday with my friends were like, oh, hey, maybe I'll ask out that cute researcher for a drink after this boom, that's like anticipatory dopamine of like, oh, that's exciting, maybe I'll drink that and that's fun and enjoyable. And that activates the nucleus incumbents. But in the heavy drinkers or the problematic drinkers, they didn't have this lower shredum activity. The nucleus incumbents, they had the dorsal upper shredum activity. So they were being triggered or feeling compelled to drink. Not because it was like, oh, that'll be fun, but simply because it was triggering that urge to drink, that craving to drink and that drinking would create stress, and stress pushes them to drink. It's only problematic because using drinking as your primary coping habit creates more stress which then reinforces that. And that's when it starts to move into addictive behaviors. When we start doing things because we enjoy them, but simply because they are triggered and we can't do them, or not doing them creates more stress which then pushes us to do them. So this week's intervention will hopefully help with some changing some of your habits. We'll talk more about it in section, but this week's intervention is about utilizing your strengths. You're going to think about three different strengths that you have, and on three separate days, you're going to pick one of those strengths and feel like I'm really generous. Okay? Try and be really generous that day. And then at the end of the day, write a five minute reflection about how you utilize that strength and how much you apprelecture 7ciate that about yourself. We'll talk more next time about why that is helpful. Thank you.

# Week 4 lecture 2

Okay. So this interview, yeah. Perfect. Welcome back. I would also, I would like to say, I appreciate you guys for prioritizing your education by coming in person. I know I post some of the videos online to help if people can't come because they're sick or they have some other uncontrollable conflict or just as review. But really in person learning is the best way to actually engage with this material. And I think a lot of people who watch the videos devalue their own experience. And they do it because they believe that it is just as valuable. And a lot of times we don't realize how we're getting in our own way because you're like, oh, but I'm doing this is so much easier to do this or do that. And there are many things that are easy that your nuclear incumbents will pull you towards, which are not necessarily taking you in the direction that you want to go. It is certainly easier to watch a video than to go to a lecture. Does that not necessarily mean it's better for you? And so it's helpful to understand what your limitations are, what your priorities are, so that you can actually move in the direction of what's most important to you. So I appreciate your presence. Perhaps it is a gentle scolding for the people who are watching this video, but it's really a gentle encouragement of reminding you like, hey, you are spending lots of time going to college or spending lots of money. You may as well make the most of it. Judge, this is actually very similar to sort of the argument for the daily logging. Like you could just totally s your way through it, right? Like we're not grading you on how accurate your numbers are, right? We're grading you on whether you fill it out. Well, as long as you're filling it out every day, you may as well take the infinitestimal slightly more, you know, more time or mental effort to think, well, how am I actually feeling? Because then it will go from just this busy work to something that is actually useful. And I think a lot of times it's very easy when you have lots of stuff to do in college to start to think of all of these things as like busy work and obstacles that you have to get through as fast as possible and lose sight of the bigger picture of like, why are you here in the first place? And part of the reason I bring that up too because it's very much related to this concept of changing habits. And that's what we're going to focus more on today. But before we get into more of the meat of today's lecture, I just wanted to remind you first that the mid term is on Monday. It's an online exam. If you have CAE accommodations, I'll input those so you'll have the right amount of time. Otherwise for most people it's 80 minutes. That's the same length of class. So you can take it online wherever you are during class time. So we know at least you have that time open. But if you want to take it another time during that day, I selected, you know, sometimes you can start anytime after 04:00 P.M. or up until 08:00 P.M. That's fine. Yes question. Oh yes, Excellent point. So there's no lecture that day. That's an important point to remind you. If you show up here, you can feel free, I don't know if the rooms unlocked, but you could feel free to you take your exam here. Actually, it might not be locked. It might not be unlocked, so don't come here. It's open. Note, so you can go through the slides, You can go through the notes, you can go through the readings. I do have office hours this afternoon as all Wednesdays are over zoom today we can focus on answering questions about the mid term. I'm happy to provide a brief review or something. If you have questions about the mid term, then you should come to office hours. Any other questions about the exam? 50 multiple choice questions? Yes. Today's lecture will be on the exam. The exam will focus on the information in lectures. You have a lot of readings. Sometimes people get caught up because they're trying to memorize everything that they read. You should focus on the lectures. The reading should hopefully inform or help you understand the lectures better. Yes, if there is a reading that I talked about or mentioned in lecture, you should probably understand the main point of that reading. But you don't need to try and memorize all of the details of the reading. But yeah, if you have more questions, you should come to office hours. One other point that I wanted to make was from last lecture about reinforcement learning. Reinforcement is how we create habits and addictions, and addictive behaviors and habitual behaviors. They get rewarded. They benefit us in some way. And they get strengthened in the brain and we do them again. I talked about how we can use different frameworks of reinforcement to encourage specific behaviors in say rats. If you use a fixed reinforcement schedule, like you get a reward every five times you press a lever, every ten times you press a lever, then you can get the rat to press a lever more. But crucially, if you stop rewarding that, you stop reinforcing it, then the rat will stop pressing the lever because it's like, this is bullshit, I'm not going to do this anymore. Whereas if you use a variable reinforcement instead of say exactly one reward every ten lever presses, you say, ah, well, you get a 10% chance overall. It's kind of the same thing, but it changes it because at any given lever press, you might win, you might not win. You could press it ten times and not win. You can press it 20 times and not win. And therefore, it creates a lot more uncertainty when you stop rewarding the animal. It's created an addiction. We'll keep pressing it even though it's not being rewarded anymore. But one of the key things about this is that the variable reinforcement has to be related to the actions that the rat is taking. If you just, um, if you take two rats and one of them has a, they both have levers, it's just that one, it's like that levers, a slot machine. And every time they press it, they have a 5% chance of getting an injection of cocaine or sugar water. The other rat also has a lever. It's just not connected to anything they can press it. But whenever rat A presses the lever and the reward, then rat automatically gets the reward. What's interesting about that, they get the same rewards. They both get the exact same number of injections. The exact same time of cocaine or whatever it is. It's just that for rat is specifically related to the press the lever. Not every time they press the lever, but every time they press the lever, like oh, I have a good chance. Whereas we, sometimes they press the lever and nothing happens, and sometimes they're just walking around their cage. Whoa. What is that? They get an injection of cocaine. It's unrelated to them pressing the lever. Therefore, they don't get addicted to pressing the lever because there's no behavior that's being reinforced rat, when you stop giving them injections, they will just keep pressing the lever hoping to get it back, hoping to get their next fix with rat B. They don't really care about the lever, like they might have some withdrawal or whatever, but there's no specific behavior that's being reinforced. So it's not just randomly rewarding people or rats or whatever to get the behavior. It has to be related to some specific action that they're taking. You're just rewarding them in a variable way when they do that action. Does that makes sense? So I just wanted to clarify that. Okay. So today we're going to be focused on how we can use the information that we learned about habits and how they drive our behavior. And how we can therefore sometimes change our habits to create more positive habits. I'm going to use this example of F because I feel like this is a good habit that many of us aspire to do and have a really hard time of changing, even though we know it's good for us. I remember one of my favorite comedians had a joke about it. I can't remember how we said it, but it was basically a start flossing as it is to quit smoking. But this also makes a point about not all habits are the same. I think sometimes we have this idea like how many days does it take to create a habit? Well, it takes a lot fewer days to create a heroin habit. It takes to create a habit of flossing. I don't recommend you trying that experiment, but it has to relate to like, well, how much dopamine does it release in a variety of other factors. But I had this experience of trying to floss for a long time and not being consistent about it, or rather I wasn't really trying to floss. I was frustrated that I would occasionally get cavities or that whenever I went to the dentist, they're like jabbing at you with their metal pick and then they're criticizing you because it hurts. And they're, wow, you should really floss more and then you kind of have to lie like oh yeah, I floss occasionally. And then like you feel bad that you don't floss. And that's the time, the only time that I think that most of us think about flossing. So when you're sitting in the dentist's chair being scolded for not flossing, and it feels like this thing that you have to do to avoid being scolded by the dentist and to maybe avoid some cavities or dental problems some long distant time in the future. And I remember in college was the point I had a couple of cavities and the dentist your fault. And I'm like this victim blaming. But after that, later that night I went to a swing dance. It was very popular in the late '90s. I was dancing with this girl and the subject of oral hygiene came up. Well, you got to talk about something. Yes, oral hygiene, uh, you got to text up something while you're dancing. And I was just sort of joking. I was making similar check like, oh, is aren't dentists So annoying when they're just like always constantly bugging you about flossing. And she had a reaction that surprised me which was, oh, I love flossing. And I was like what? Like who loves flossing? She's like, oh yeah, like you just feel so productive and refreshed after. And I was like, oh, I hadn't really thought about like, oh, there's some positive benefits in the short term to flossing. And she went on, she was like, yeah, and it's like a treasure hunt. You never know what you're going to find. And I was like, well that's, you know, my initial reaction was like that's kind of gross but like this also like later made me realize like it's kind of similar to mindfulness. And that a lot of times, like in mindfulness, we have these negative emotions floating around in our head, just like in our mouths. We can have this, you know, gunky stuff sitting in there. You can feel free to ignore that the people around you are probably affected by it. The people you're dancing with or talking with, they can smell your bad breath. And yeah, flossing is kind of uncomfortable and gross, but that gross stuff is already there. You're just getting rid of it. And the same sort of thing of mindfulness is that we have these uncomfortable negative emotions that we're pretending aren't there. That doesn't mean that they don't impact your life or impact the lives of the people around you. You're just pretending and mindfulness is harsh of just becoming aware of what is actually there so that it stops having the negative impact on you. So the biggest thing I think that shifted my focus about flossing was this notion of choice. Moving it away from this thing that I had to do to avoid the negative consequences of tooth decay, or avoid the negative consequences of being yelled at by the dentist. And instead, oh, maybe this is something I would want to do in order to get some positive consequences. When it comes to your actions, Yes, we have multiple motivations for them, but oftentimes there are things that we feel like we have to do. And there are some things that we want to do to get positive consequences, but oftentimes those are the same thing. And it's just that the more that you focus on the negative consequences and your lack of control in this situation, the less it feels like you have a sense of choice in the matter. The less agency you have, the more you're like, oh, what's important to me? What do I want, what do I want to move towards? That increases your sense of choice and makes it easier to change those habits. And that's just part of it, though, that's just like one little snippet of it. Because there are also some sort of dumb behavioral activation type things that you also need to do or will be helpful to change habits. It's not just a sense of choice and feel like, yeah, that's good, but also when I had this idea, I was like, oh, well then I should probably buy some dental floss because it's one thing to be like, oh, I'm so motivated to like floss my teeth and then, oh, I can't do anything about that. There's no dental floss here. Oh, well, like, okay, well sometimes the answer is doing some stupid thing like okay, just walk over to CVS and like buy some dental floss and then have a plan like, are you just gonna floss whenever it pops into your head? Well, then it's also inconsistent. Well, no, I was like, I'm going to floss after I brush my teeth, I'm not going to forget to brush my teeth. Therefore, when I'm brushing my teeth, that is the cue for the routine of flossing and also having the dental floss sitting right there. Oh, it reminds me I should floss. So that's a trigger, the routine is the flossing. And the benefit is like, oh yeah, I do feel refreshed. Oh, I do know that I'm protecting my teeth. Oh, I do know that I'm going on a treasure hunt and a for all of these factors are playing a part of it. And since that point, I should say like from that point I basically flossed every day for like 20 years. It took a while to start that habit. Like I did it one day and then I forgot for three days. And what normally happens is when you forget, then you yell at yourself, Oh, it's just stupid to me, I knew I couldn't do it. And then that doesn't actually help you change your habit. Instead, now you just fall into your old habits of self criticism. So I'll keep trying and you keep trying and keep trying, and then eventually it becomes a habit because it takes time to wire those things in the brain. So one of the things that helps change habits and also increase our sense of choice and agency is this concept of self affirmation. Which is very counter to the way that many of us go about trying to change our habits. Most of us try and change our habits by seeing something that we don't like, that we're doing, that are focused on the negative consequences. We try and criticize ourselves into changing. You idiot, you moron, you loser. You need to change this, or you're going to keep experiencing these negative consequences. That self criticism, by the way, is also a habit, but it doesn't usually inspire us, it doesn't usually motivate change. And so in this particular study, they said, well, let's try. Instead of getting people to focus on their negative qualities, they want to change. Let's say well, what are your positive qualities that you wouldn't want to change? So they had them fill out questionnaires that got them to focus on their positive qualities. Like have you helped someone like please elaborate or have you considered other people's feelings? Like if yes, please elaborate. And so they had some people do. They didn't tell them that they're doing self affirmation, they just fill it out. Questionnaire that, you know, made you focus on your own positive qualities. Whereas other people had a control questionnaire that was like, do you like chocolate? Like if yes, please elaborate so you're still writing stuff, but it's just not related to your own positive qualities. And they found in a couple different studies that the types of self affirmation, like focusing on your positive qualities, helped lead to habit change. In one study on quitting smoking, the people who took the survey, the self affirmation version, were significantly more likely to pick up a pamphlet on how to quit smoking after as they were walking out of the room. I love when they do, some say they don't tell you the point of the study. The point of the study is like something else up here. They're just measuring like how much, how many pamphlets are people picking up. And I was like, oh just you don't know the study, you're like, oh oh yeah, maybe I would like to quit smoking. Nothing about it was telling you to quit smoking, how smoking is bad for you. You just focused on your own positive qualities. Another study showed that healthy eating showed that people were much more likely to increase the amounts of fresh fruits and vegetables that they ate in the week following the survey. And this Leads to habit change. Because you're focusing on your strength, which is it's a form of gratitude, like, oh, I'm so glad I'm good at this thing, I'm good at this, I'm good at that. You're focused on what you can control, which helps reduce the stress reactivity, or the emotional reactivity. Because sort of by definition, your strengths are things you're good at. Your bad habits are things that you're bad at that you can't control. And therefore, the more that you focus on things you don't like that you can't control, the more out of control you feel. And when you feel out of control, it pushes you back into your old habits. This is one of the reasons why we have you do this strength intervention this week. Now, I just alluded a couple slides earlier this behavioral activation concept as just like one way for changing habits. So I just wanted to go into that a little bit more. You mentioned CBT, or cognitive behavioral therapy last week, and I just wanted to point out there are many versions or flavors of cognitive behavioral therapy. Originally, it was just developed as cognitive behavioral therapy in the '50s. And then people are like, oh, well, some versions emphasize the behaviors more emphasize different parts of it. Now there's all these different kinds, but sometimes it's easy to get lost in the dogma When someone's like, well this is my therapy, this is what we focus on like, okay, your brain doesn't always make these distinctions, but I just want to talk about these three main flavors of cognitive behavioral therapy and how they're different and how they're similar. The first is behavioral activation therapy. This came about because some researchers noticed like, okay, like people with depression, they have unhelpful thoughts. They're always focused on the negative, they're catastrophizing, and they have all these unhelpful behaviors, they're isolating or they're self medicating, or whatever some researchers noticed, it's really hard when you're depressed to focus on those thoughts because they're abstract and you're feeling very overwhelmed. Like let's just focus on the behaviors? And they found that if you just in depression at least just focused on the behaviors and made it easier to take positive behaviors. That was just as effective as focusing on the thoughts and the behaviors and it was easier to implement. Behavioral activation therapy emphasizes that the context that you were in, the things that are triggering your behaviors, are more important than focusing on the internal factors of the thoughts that those trigger. If you're trying to work out more well, you could try and understand what are the thoughts that are getting in the way of working out. That's a cognitive strategy. Or you could just to the gym, like just changing your environment. Like oh, do I want to work out now? I guess it doesn't seem so terrible as it did when I was sitting on my couch. Or just dumb things like set a reminder or is there something that I want to do today? Oh, I should put it in my calendar. So behavioral activation is kind of like a lot of dumb strategies that sometimes it's difficult when you're like really analytical, intelligent college student or graduate student or adult like no, I'm smart, I should be able to figure this out. And sometimes the answer is just dumb. Like, you want to floss more? Yeah, you could try and figure out what's getting in the way or you could just literally buy some dental floss and just like put it on the counter. It's just sitting there. It's much easier to start flossing when you just see it sitting there. Oftentimes, it's easiest to start focusing on the negative behaviors because there are a lot of behaviors that we do. I'm sitting, trying to study in front of the TV, and I keep watching TV and it's disrupting my studying. Oh, well, I could just go to the library instead of. Trying to study while I'm sitting in front of the TV and then I'm going to stop triggering that negative behavior. And so it becomes much easier and more automatic to just start studying because I'm not doing these negative behaviors. Mindfulness based cognitive therapy focuses on improving the skill of mindfulness. And it's sort of like the opposite of behavioral activation. It's like, okay, let's just be fully focused on the present moment. Practice non judgmental awareness. We're going to improve your ability to concentrate because oftentimes the reason we fall into these unhelpful behaviors is because we're not even aware of the thoughts or emotions that are distracting us. Or we just don't have an ability to just stay focused on what we are doing. And so mindfulness based cognitive therapy focuses on those factors. And then there's this other version called acceptance and commitment therapy, which was like, oh, like maybe we should take some of that and some of this and maybe that would be even better. So acceptance, commitment therapy does have a lot of mindfulness components because it does emphasize instead of trying to control your thoughts or your feelings like you just accept them, that's the acceptance that's also a key part of mindfulness. The commitment part of this is that you shouldn't just like do stuff as behavioral activation therapy says. Like behavioral activation therapy is like a lot of stuff from the book. Like yeah, just start exercising, go to sleep on time, start eating healthy food, hang out with your friends. Like you can make a list. It's a dumb thing, you set reminders, it's like do it. Um, acceptance and commitment therapy is like okay, when you're stuck, you shouldn't just start like doing random stuff. You should figure out, well, what's the most important goals that I have? What are my values? And commit to taking action that moves me towards my deepest values. All of these are great approaches. The only problem I have with them is when people start arguing that like no, this approach is better than that approach. Like oh, you shouldn't do this like no. They're all just different tools. Some might be more helpful for you at this specific moment because you're neglecting, you know, one entirely. But it's helpful to understand how they work so we can be flexible about choosing the right tool that's best for what I'm trying to accomplish. Yeah, EMDReahl. So she's asking about EMDR, which is eye movement, something that isn't traditional cognitive behavioral therapy but also, I mean, there's like dialectical behavior therapy is a form of CBT. There are lots of treatments that have elements of CBT, but EMD, R has some elements of CBT. And the only problem with any of them is when they try and present themselves is like, well, this is the answer. And in this treatment we do it this way, it's good for you, buddy. Your brain doesn't make those distinctions More helpful to understand like, oh, how are these things functioning? And then you can build up your toolbox and understand yourself well enough to know which tool is going to help. General CBT practice might be like write down some thoughts that you have about school that make you feel bad and then, oh, you'll get faster at noticing. Oh yeah, if I get a B, then I think I'm going to fail and be a loser or whatever. Behavioral activation, you write down what you did last weekend that made you feel good and then create a plan or a reminder to do some of those things next weekend. Mindfulness based cognitive therapy might be going to practice meditating or practice mindfulness or practice being mindful throughout the day. Acceptance and commitment therapy might ask like, well, what are your values? And what are some actions you could take that are consistent with those values? Do you have a question? Yeah, the difference between ACT and DBT, I actually care that much about the differences. So I'm not going to really answer the question because like in practice, I think they are much less different than they seem to be. Because to practice behavioral activation therapy say like behavioral activation and mindfulness seem to be the most different. But like how do you, you know, actually do the things that you put on your calendar? Oh, well sometimes you have to be mindful of the emotions that you're experiencing that are making you avoid doing the stuff on your calendar or while you're being mindfulness. Great, be mindful. But like, what are you doing while you're being mindful? Like, are you just sitting there? Like I should be mindful Or like, oh, you're going for a walk and you're trying to be mindful during these things. So they're just sort of like different flavors or different emphases and sometimes the people who came up with them have different tools that they focus on. But it's not as always helpful to focus on all of the details. Yeah, yeah, So they're different perspectives and they're all kind of intertwined because they're all based on the same model of CBT, which is that, oh, you have thoughts and behaviors and emotions and are all kind of connected to each other. And they're all based on these beliefs that you have about yourself, about the world. And if you recognize those beliefs, then you see, oh, that's what's triggering these thoughts, so these emotions. And if we just change those, then we'll change, you know, the output of the system. The thing that distinguishes CBT from, say, psychodynamic therapy or psycho analysis is like, psycho analysis is like, yeah, but like, let's dive deep into specifically like the meaning behind these things and where they originated from. And that's super useful too sometimes that helps you realize what your values are. I point this out because sometimes we get stuck because we're just trying one approach and there's no reason you can only have to try one approach. Yes. If you're trying to be consistently, you know, happy and productive, at some point you will probably need to be clear about what your values are and take committed action towards them. And set up goals that are in line with those values. And break down those goals into smaller actionable steps. Sure, yes. But like if you're totally stuck and you're depressed or you're anxious to like, I don't know what my values are, that's why I'm depressed. Ah, well then sitting around for weeks trying to figure out what your values are, not helpful. Probably more helpful like, well, just start exercising and going to sleep at a regular time and just doing these dumb behavioral activation techniques. And either that will entirely solve the problem or well, it'll solve part of the problem. And then you can, oh, then I can figure out my values, or sometimes it's like the opposite. Oh, oh, you're right. I know what my values are. Oh, I know what actions I need to take and I can commit to those things. Um, so there's just different ways of approaching the problem. I talked about this piece last time that all habits have the same structure. These different forms of cognitive behavioral therapy, like help us take advantage of this information in different ways. But all habits have this structure. They're triggered or cued by a light sound, walking into a classroom, walking into a party, someone saying something, you, someone's tone of voice, whatever. They're all triggered by something. And then you do something or you think something, and that benefits you in some way and therefore gets reinforced. And those connections get strengthened in the brain. And these can trigger each other like one habit can trigger another habit, can trigger another habit, can trigger another habit. And all of that can happen outside of your conscious awareness. Like um, oh, I noticed that I made a mistake and I forgot to floss, but I had a goal of flossing. Oh. And then that triggers the habit of self criticism. Like such an idiot. Why does that trigger the habit of self criticism? Oh, because making a mistake is stressful to me. Because I'm like, what had a goal? And I'm smart, I should be able to follow through on my goals and that's stressful. What do I do with that stress? Oh, my brain's like, oh, I know the best quickest thing you can do is just deal at yourself and then you'll feel like you have more control over the situation. Great. But sometimes we do habits to, you know, maintain. A sense of control or to deal with those emotions, but they're not naturally the best way to deal with that emotion. They're just the way that we've practiced the most, or they're the most automatic. So yelling at myself and then feeling, oh good, I'm glad I punished myself. Well, that doesn't solve the problem of I want to floss more and yet we keep doing it because it is a habit and because it works to deal with that emotion in the short term. To change our habits, we can use our understanding of structures to realize there's a few different points where we can intervene. One and sort of the simplest kind of behavioral activation approach is realizing that, oh, all habits are triggered by something. And if we change the trigger, if we understand at first like what the trigger for that habit is, then we can avoid that trigger and then boom problem solve, we don't do that habit anymore. So this could be a thought, an interaction, external stimulus, or so on. This is why if you're an alcoholic, one of the suggestions is like, we don't have alcohol in your house, hang out with people who you used to drink a lot with. Don't go to bars or places where they're consuming lots of alcohol. Why? Like it's just a dumb behavioral activation technique that because you can't always control your cravings. But if you see a bottle of alcohol or for any of us who don't have alcoholis in like if you, your roommate had cupcakes sitting on the table right there, Well, that's ooh, you weren't even thinking about cupcakes before, but now you are. Now, all of a sudden, now you have to manage those emotions that come within those cravings that come with it. So one of the reasons why we want to change the trigger is to avoid, you know, triggering that initial desire to start thinking about it in the first place. Because it is much easier to avoid temptation than it is to resist temptation. So if you could, just like sometimes we like I had failure of willpower, I just ate too many candy bars a Well, why did you eat too many candy bars? Were you standing in the candy aisle at Ralph trying to convince yourself to not buy candy bars? Oh, well, we all have terrible willpower. If you rely on willpower to set yourself up for success, you're probably gonna fail. So just don't trigger all of those thoughts so much. The other thing is like, well, you can't help but have these thoughts sometimes pop into your head if you have an addiction to alcohol or candy or whatever it is. But like at least if it's not there, then you can't impulsively act on it. One of the problems like with alcoholism is you're telling yourself, I don't want to drink, I don't want to drink. Oh, but there's alcohol there then, like you have to resist that craving and you can tell yourself, no, don't drink, don't no drink. But the second your prefrontal cortex is distracted or overwhelmed by something else, like your straight, um, is like, oh great, describe a drink. And you can just start doing these behaviors and not even have any conscious awareness, even though you specifically intended to not do them. This is also related to changing your environment. Because some habits aren't triggered by a specific cue. They're triggered by the environment that we're in. This is why you're much more likely to dance or feel like dancing when you are at a party with music and other people dancing. And you don't need to inhibit your habit of dancing right now because it's not reinforced in this environment. It's much easier to use a previous example to get yourself to exercise when you are wearing exercise clothes and you are standing in the wooden center. And it's much harder to get yourself to exercise when you're in your pajamas and you're sitting on the couch. The environment triggers different things. Yeah. Okay. Right. So her question is like, what about a situation where you can't control the cue? So that's an excellent question. I'll talk about that in a moment. But this is the point where sometimes you can control the queue. So you should at least do those things. You can't always control the cue. But if we're often focused on, well, I can't always control the que, I can't do that. Okay, great, stop focusing on all the things that you can't do and start focusing on the things you can do and that will help the change in the environment. A result of like, well, that's how the hippocampus works. And your hippocampus is constantly scanning your environment to decide like how should I feel? And it's sending that information to the amygdalins, how should I act? And it's sending that information to the dorsal stratum. Sometimes the simplest answer to change your behavior is to just change your environment. But a lot of our habits are triggered by stress. Either because stress in general just prompts us to be more habitual or because they are specifically our coping habits that we have trained our brain to use to deal with stress. In either case, anything that we do to reduce stress, if stress itself is the trigger or exacerbating a response to the trigger, then anything that we do to reduce stress reduces either the trigger itself or reduces the impact of the trigger. And that's what so many of, so much of the stuff that I talk about in this class is just like, okay, well you're focused on this one little specific thing that you're doing. How do I stop eating cupcakes? Oh well, like you're eating cupcakes 'cause you're stressed about your exam and you're just trying to, you know, make yourself have a moment of happiness in this month of mid term terribleness. So like stop being so mad at yourself. Just figure out, oh, how do I just turn down my stress a little bit this whole time? And then you won't feel the need to act on those bad habits. The other part of this equation is that recognizing that all habits benefit you in some way, if they didn't benefit you at all, you would quickly stop doing them. It's just that, um, well, so you can know that if you're doing a habit, a lot of times you're like, oh, I didn't want to do that, that's stupid, and that triggers a habit of self criticism, blah, blah, blah, blah. But you can flip it on its head and realize, oh, the fact that I am doing this, this benefits me in some way. How? And if you can figure out how it is benefiting you, then you can potentially figure out some other way to get that same benefit. Because your brain is trying to get you to get that benefit. It's just the specific habit is causing negative impacts. So like, oh, I'm drinking a beer to just like calm down and relapse after a hard day, a hard week, okay? So it's clearly important for my brain to learn how to calm down. Is there some other way they could figure out how to calm down without drinking a beer? And that doesn't have the same negative long term consequences. So a lot of times the challenge is like it's easier to understand like what we are doing. It's harder to see like, but why am I doing that? How is it actually benefiting me? 'cause we're often stuck in this mode of like it's not benefiting me, it's only hurting me Sometimes the reason it's benefitting you is simply because it is already programmed as a habit. When you do your habits, it calms down the stress response. So the only reason it's benefitting you is to help keep you calm and give you sense of control. It's an unfortunate downward spiral if that habit that you're doing also creates more problems in the long term, like procrastinating or overeating or drinking too much alcohol, you do it simply because it's there as a source of comfort, but then it causes more problems. This is related to what I talked about last time with like the problem drinkers in that FMRI study where, yeah, maybe initially when you start doing something, you do it because it's fun or enjoyable. But the more that you repeat it and the more that your brain figures out, oh, this is a really good way to feel calm in the face of stress. Well then it starts getting programmed in your dorsal stratum and then you just do it simply because it is programmed in your dorsal stratum. And doing those programs helps calm you down in the short term. Breaking out of that pattern will mean that you'll have to feel worse in the short term because it's always easier to fall into your habits. And so this is where acceptance, commitment, therapy comes in. It's like, why would you just make yourself feel uncomfortable in the moment? Why not just eat the cupcake? Why not just have the drink if you can't come up with a reason for why? Like oh, I could do that. I could make myself feel better right at this moment. Ah, but then I might fail out of school. Mm. It's more important to me to fail out of school. So I'm willing to feel momentary discomfort and find some other way to get that feeling of comfort, or I'm willing to feel uncomfortable for the moment. And when we become aware of those rewards, then we can do this like sneak. Ninja move where we just a habit, with a different habit, we can replace the routine to get that same reward. Oh, I'm eating this cupcake because I'm super stressed. And it helps me have a little bit more positive emotions. It also just gives me an opportunity to take a break from studying. Oh, well, maybe if I just took a break from studying, then I don't need the cupcake. Or this is the author of this book, The Power of Habit. He noticed himself that he would, and I noticed this too. When I was writing my book. I was like, take a afternoon break to go get a cookie And like he was like, hmm, I don't want to do that habit, I'm writing a book about habit. So he realized, oh, I'm kind of taking a break to get a cookie 'cause I just, I just needed to take a break and it's like fun to go get a cookie. But he didn't want to eat so many cookies. So he's like, oh, let me try just taking a break and going for a walk. And he's like, oh, didn't quite do it. He's like, oh, maybe I'm hungry, I need to eat something. He's like, oh, let me take a break and eat an apple. Oh, that sort of is it, but not quite. And he realized like, oh, part of it is taking a break, Part of it was improving his positive emotions and that eating a cookie was a way to get both of those things. But he realized like, oh, or I could just take a break and like go talk to one of my friends because that's engaging and it keeps my positive emotions and I'm not thinking about work and I'm feeling better. And then I can go back to work. And he said that worked because it fulfilled the same needs that eating a cookie did, Just didn't have the other negative consequences that he was trying to avoid. So, so this brings me to one of your readings about getting things done, which is a very behavioral activation approach to all of this. So, I just want to summarize some of their findings or some of what their recommendations I should say. Judge, the idea is like, well, you just need a system. And the system ideally shouldn't be just random posted notes that are put on random places in your apartment, and sometimes it's on your phone and sometimes like have a system that makes sense to you. Whether it is I put all of my stuff on my Google calendar, I have a planner, whatever it is, that's fine. Just come up with your system. It could be bullet journaling. It doesn't matter. There's have a system that you can trust. Because the problem is when you can't trust your system, like oh, every time I have a deadline I write it down. Well now if you worry about I have been missing something. Well then you can look at your journal and like, oh no, great solves the worry. But if you can't trust the system you've put in place, then it's kind of pointless because you're like, oh, do I have, oh, maybe I forgot to write it down in here. And then you still have that anxiety. And the point is that you can't get things done as well. You can't be as efficient and productive as you want when your mind is distracted by all these different emotions. If you can take all of these things that you're worried about and put them, your long term goals, your short term goals, into some more logical system that is outside of just you thinking about it. It makes it much easier to be productive, but that sometimes means you have to be disciplined about all of the inputs that you let in your life. For example, when you're trying to do one thing like studying. And the thought pops into your head of like, oh, maybe I should check my e mail. Well then you check your e mail and then like three things come up. And then including, oh, your mom reminding you, have you buy your tickets for home for Thanksgiving. And then you're like, oh, then you have to go on a website and whatever, and you have to be like, no, I'm doing this one thing, I'm not going to just check my e mail randomly, or if I do make a mistake or some random thought pops into my head, I have a system. Okay, I'm just going to put that as a reminder later in my calendar. I don't have to deal with it now, but I do have to deal with it in some small way in that I have to make a plan for later. I can just put on my calendar, takes 2 seconds. Oh, right. Put on my calendar for tomorrow, buy tickets or, you know, buy plane tickets. And basically just these ideas like if it's on your mind, you're thinking about it, your mind isn't clarify what is the goal here, what are you committed to? And decide what you have to do right now to make progress towards it. That doesn't mean you need to solve the entire problem. That doesn't mean you need to buy plane tickets right now. It just means, oh, set a reminder tomorrow to buy plane tickets and then just be consistent about that. And once you're consistent about that, then it becomes much easier to have your mind be clear. So now we'll get into more of the neuroscience of this. And how this works, and how changing your habits utilize other aspects of the brain. And this is where setting goals or creating intentions can be really powerful. Because they allow your pre fundal cortex to help regulate these lower level regions. They change your attention. They even change the way your brain perceives the world. When you set a goal, it tells your brain like, oh, well, you can filter out and ignore this stuff and start paying attention to this stuff. They can even enhance our enjoyment of the world. And I'll show you what I mean by those things. In this particular study, they had a really silly intention that people were trying to do in most scientific studies. You have to like abstract it out and make it small enough to be manageable to where it's like not really applicable to real life, but that's where we have to extrapolate out. But in this particular study, they showed people like these kind of weird random dot patterns were like a different color that you might be able to point at. Or sometimes the dots were a different size you were supposed to indicate with your hand. Like how big the dots were. They told people before these dots like flashed up on the screen to, to do one of those two actions. They say okay, to point, to indicate the size of the dot. And then they flashed up the dots on the screen. Sometimes were things that were more easily point at a bowl because they're a different side. Sometimes the dot was a different size and it would make more sense to indicate with the size, with your fingers. But they showed that when you were preparing to take a specific action, it changed how the brain just perceived these dots at the level of the visual cortex. This is they did EEG signals measuring from this visual cortex that the visual fields, the visual stimulus was congruent with the action you were about to. Your brain had a different response than when it was incongruent. So if you were like preparing to grasp something and then it showed something that wasn't graspable, you're like, what, huh? Then your brain perceived it in a different way, the actions that you were about to take. This is the summary of this change, the way your brain perceives the world. And a lot of times we're like, oh, these terrible things are happening to me and we don't realize like oh, well what are my intentions? This is like the BS field of like manifestation. I hate to break it to you. Like manifestation and the law of attraction, like they're not real, they're BS. If you're familiar with any of those. Yeah, I hate to break it to you, but they're also real. So the law of attraction or the Oprah's book Club book, The Secret. Like, it's based on these ideas like well, if you just, you know, you've created an intention in your mind and you take action, you believe strongly, Then you send these energy vibrations out into the universe, and the universe manifests that for you. That theory, that explanation of it is what is BS? No, that is not happening. There's no scientific evidence for any of that. What is true is that it, well, it feels like we can manifest things. Why? Ah, because when you decide, hey, you know what, I'm going to make $1 million by the time I'm 30. Okay, well then all of a sudden, now your brain starts shifting how it is perceiving the world. The same inputs are there, but your brain's like, oh, I'm going to ignore that advertisement for becoming, you know, band camp counselor. That's not going to help me get to like, oh, oh, I can get an internship at Goldman Sachs. Oh, like literally those things are accosting you all the time. There's posters all around you. There's 1 million people on Bruin Walk like hey hook and like your brain needs to know like what people should I filter out. So that I can hear the one voice of like, hey, you want to internship at Goldman Sachs and he's like, oh yes. How does your brain know how to do that? Depends What are your goals and how committed are you to achieving them? So you can, your brain is always doing that. It's just that we're not always intentional about the goals that we set re the intentions that we have. Decisions. I'm sort of lumping together these ideas of decisions and goals. Decision is just to make an intention to act on a very short term goal, or long term goal or whatever. It can change how enjoyable things are, by the way. So one side example of this idea of intention. I remember in my '20s I was really frustrated that I didn't have enough dating opportunities, so I signed up for Match.com This was like before Tinder, all this stuff. Within, I don't know, like two weeks, I had like three dates lined up, but none of them were from Match.com One was like this law student who I met like a grad student mixer. Another was like a girl on the bus who was like reading the same book as me. And I was like, wow, that's weird. Like these people were around me all of the time. But it wasn't until I took action and signed up for this website that my brain was like, oh, I guess you're serious about this. Like you want to meet some, okay, then I'll start paying attention to that. And so by yes, you can create an intention, but sometimes just thinking about something isn't enough. Because you think about things all the time that you don't act on. And so your brain gets used to ignoring all these thoughts. So you're like, oh, maybe I should study more, maybe I should exercise more. But you've told yourself that for the last six months you haven't done anything about it. So your brain, it's like, oh, I can ignore that. Just like if you had a friend who always told you, hey, we should hang out on Friday and then they didn't follow through then, okay? Instead of continually getting frustrated at this friend, you just realize like, oh, they're just saying stuff and you're like, oh yeah, let's hang out. And, you know, it's never going to happen. And that's the relationship many of us have with ourselves, that we tell, oh, I should do this, I should do this. And that's why taking action is so powerful. Because it sends a signal to yourself, oh, I guess I mean that. And then it changes the way that your anterior cingulate and the rest of your brain filters. Information decisions also enhance enjoyment. In this particular study is an FMRI study where they had people play this gambling game where you essentially had to blow up a balloon. A virtual balloon. But if you like went too far, it would pop and you lose all your money. So it's just a form of gambling where you could just decide to take another risk and maybe win more money or risk losing at all. You did this in one of two ways. Either you made the choice to risk the money and take the gamble, or the computer made the choice for you. And interestingly, when you were in control, sorry, when you were in control of making the decision, you didn't have control over the outcome, but you made the choice. It increased activity in, in the insula and in the nucleus succumbents felt it, rewarding. You felt it. If I take action like I'm going to choose, I win. I'm like super excited. Like oh, my heart beats fast. Oh yes, I made the right choice. But it also means that if you lose, you also feel that more deeply when you choose to take action. It enhances your emotions, your emotional experience. It's just unfortunate sometimes when we have really negative emotional reactions and we're like, I want to avoid that feeling, I don't want to be heartbroken again. I don't want to fail a class again. I don't want to, you know, look stupid again. Then your brain is like, oh great, I know the easiest way to do that, just stop being so, you know, intentional about everything. Like just let stuff happen to you because if the computer is making the choice for you, oh like yeah, you don't get as much incitement and enjoyment from it, but also, you know, you don't have as much heartbreak. And this is why when sometimes people are depressed or we're just feeling overwhelmed, become passive. Because we're focused on like, I don't want to make the wrong choice. So our primary goal is to avoid the negative emotions that come with making the wrong choice. And it comes at the cost of our positive emotions. And so we sometimes wonder like, well, where did all my motivation go on? Why aren't you more excited? Because often the best solution is like, well, learn to deal with the negative emotions because otherwise your brain will make the choice. Like I'm just going to avoid those by becoming passive. Yes, that was that point. There are a lot of cognitive strategies that we can take to deal with this. One is not letting yourself get carried away by your feelings, or we can regulate our emotions by putting our feelings into words. This particular study did what's called the Monetary Incentive Delay Task, where they just show you some money that you can win. A dot pops up and if you like press the button fast enough and you win money. But they had and you either showed people like either a nickel, I mean this was in the Euros, you know, in Euros. But whatever they showed people a nickel or like $1 and then, you know, you might be more excited to win $1 That might change your emotions, might change your behavior or your action time. But they also had told people how they should think about this task differently in different situations. So one time they just had them like permit their feelings. Just basically like, yeah, do go with whatever your feelings are telling you. Don't try and regulate them at all. Versus the regulate condition which is related to one of the experiments I talked about earlier in an earlier lecture of like yeah, well just remind yourself, okay, this is just one of many trials like yeah, I don't know if I'm going to win or lose on this one, but it's just one of many. Or put it all in perspective, like it's $1 like it's not that much money in the grand scheme of things. So you're regulating your emotions and then they looked at their reaction times. Just behavior of how fast they responded. You can see here that the reaction time to when they, we're permitting their feelings and we're just expect a nickel versus expecting $1 Well, their reaction time was way faster when they were expecting $1 because they were like super excited about winning $1 So they react super fast. Now I would also just like to point out that it is not as big as it seems because this Y axis starts at 470 and goes to 500. So, you know, it might look like it's five times faster. It is significantly different, but that's why it's always important to look at that Y axis when you're interpreting what this means. So it is significantly faster by about 15 milliseconds. So this is showing that, yeah, your natural reaction to trying to win $1 is like automatically you're a little more excited, and so you press the button faster, and that's actually a good thing. Ironically, in this study, regulating your feelings slowed down your reaction time. Well, it was probably helpful to be excited about that dollar, but you regulate your feelings a dollars, not that much money. Then your actions treat those two conditions just the same. But what is helpful about understanding here is like, oh, well, by taking different cognitive strategies. Yep. You can successfully change the, you know, how your emotions trigger your actions. So you might not want to do that in this case, but in other cases it might be more helpful. But as it relates to the brain, they showed that the brain was responding differently to these different situations. So when you are permitting your feelings and you're just expecting $0.05 versus $1 the stratum responds differently. They didn't make a distinction between the dorsal and ventral stratum, but even the dorsal stratum has some aspects similar to the nucleus sucumbents. But they showed that, yeah, when you're expecting $1 you have a lot more reward related activity in the stratum than when you're expecting a nickel. But when you regulate your emotions, maybe either $1 you're like, it's not that big a deal, or a nickel. You're like, well it's more than I have now. Then it changes the activity in the stratum. It might either pull you more strongly or less strongly in that direction. This was caused by activity in the Dorsolateral prefrontal cortex. The Pam in here by the is just one part of the stratum. But what they showed is just like when you're doing these different strategies, either I'm just letting my emotions run wild, or I'm like, no, I should reframe, cognitively, reappraise my emotions. Oh, the dorsolateral prefrontal cortex gets involved and it is better able to regulate the stratum either to make it more excited or less excited. And this is where intentions and goals. Can come into play because, you know, the natural, rewarding aspect of, say, studying on a Friday night might not be that high. But if you're like, oh right, But this is going to help me do better on my M cat. Oh, oh, then all of a sudden like, oh, I can modulate the rewarding aspect of the action that I'm doing right now. And so therefore, when a friend's like, hey, you should go party. And nucleus comes like, yeah, let's go party. You're like, no, you've already modulated your straight item to be like, no, I'm gonna stay and study. Then there's a study called Putting Feelings Two Words. Which I really like though, as the published title of the article that was done here at UCLA. And it just means what it says. They took people, stuck them inside an FMI machine and showed them pictures of people with emotional facial expressions. And they had them do a variety of different tasks either oh, just guessing what you think their name is. Yes. I'm sure there are a lot of gender normative assumptions, but like, oh, doing shapes or one of the tasks though, was labeling the emotion that you are perceiving this scary, is this angry? The reason why they're doing this task is because when you see someone with emotional facial expression, excited, angry, scared, happy, whatever, you're mid, automatically respond. You have automatic emotional reactivity. And, but it turns out that when you label the emotion that you were experiencing, you use language. You're like, oh, that's anger. Oh, that's fear, that's surprise. Then it activates a specific part of the prefrontal cortex. Specifically in this case, the ventrilateral prefrontal cortex. You might wonder like, why isn't it some other part? I don't know why it's not another part, but it is an emotional part. The ventral part of the prefrontal cortex. I say this because sometimes people are like, what shouldn't it be? The ventrimedial prefrontal cortex. And this is where, just for purposes of the exam, I have to tell you like, yes, you should try and understand all this stuff like it's a Christmas tree and you're hanging in different little facts on this, this Christmas tree. But there's not one underlying theory that explains everything. You should still understand the basic premise of like, oh, the prefrontal cortex, the thinking brain, and whatever that helps you organize all the information. But then sometimes when it comes down to specific details of specific studies, well, this is what they found and you can try and make sense of it. But sometimes you can't just understand it on a theoretical level. Sometimes if I mention a study on the exam and you can't figure it out, I try not to be tricky, but if you can't figure it out, you can always go look at this slide, you can look at another, at the study itself, if you've narrowed it down to two answers and you can't figure it out just based on theory. So this activation of the ventrilateral prefrontal cortex automatically reduces the Amigdlas reactivity. So yeah, the Amigdla still reacts, but just not quite as much. And this is one of the key benefits of mindfulness when you just become aware of the emotions that you're experiencing. Like, oh, I'm really anxious right now, Why I'm anxious? What's wrong with me being Oh, I'm angry at myself for being anxious. Like, it doesn't eliminate the feelings. It just turns down the volume slightly. And when they're turned down the volume slightly, then your stritum is pulling you so strongly into your old habits and it becomes easier to be intentional. So mindfulness and becoming aware of your automatic tendencies, your automatic emotions, makes it easier to then make a choice. Because when you're not mindful at all, your brain just these things happen. Your brain makes a choice for you. When you are mindful, it doesn't suddenly make it easy. You're like, oh, it'll be so much easier to, I don't really want to floss right now because it's frustrating. It would be so much easier to just go watch TV. Oh, I could do that. That's what my brain wants me to do. It would be easier. Oh, yeah. But I wanted to floss. That's my intention. Okay. I still have that opportunity and I can do it. Oh. But I want that to be easy. I want to do the easier thing. Oh, I'm frustrated that it's not just easier to floss. And these are the ways that these different strategies can interact with each other. So that, that was sort of like a mindfulness based approach. Just label your feeling and become more aware. But I really like this quote. From the existentialist philosopher Nicsci. Who said that this thing, that's really more of an idea of acceptance and commitment therapy. Which is that given a big enough why people can bear almost any how Yes, sometimes things are difficult. Yeah. It's more difficult to flos your teeth than it is to not flos your teeth, but if you have a big enough reason that's important to you that's related to your deeper values of why, well, then it's easier to overcome these challenges. And one of the primary that people do in acceptance commitment therapy is to clarify your values like yeah, you're because you're not clear about what's important to you and you can't control everything. You're just getting distracted by all these things that aren't important to you. What actually is important to you? In this particular study, they intentionally created a stressful situation. They use something called the trier social stress task, which is designed to stress people out. It involves having to do some public speaking, like getting up in front an audience. And in this case it's actually a disapproving audience because they're all like plants, so they're not going to be happy with how you do. You're also not given enough time to prepare. So like I'll give a talk on earthquakes and you have 5 minutes and oh, and then you have to go up and give a public presentation. And I think another part of it is you have to solve complex math problems out loud while audience scowls at you and it's very stressful. And it causes big increases in cortisol. That's what it's designed to do. But they found that before you have people do this task, you just allow them an opportunity to reaffirm their values, to remind themselves like, what are the most important things in my life? What am I really committed to? Then it reduces their cortisol response. This control is the regular task. The cortisol levels just go wildly out of control because it's super stressful as it was designed. The people who do the values affirmation, yeah, maybe they have a slight increase in the baseline cortisol but not very much. Now sometimes when we're clarifying our values, it's that we are trying to tell ourselves like, no, this thing that I'm doing right now is super important. Like, you know, you're at practice, ultimate frisbee practice, and you're like, oh, it doesn't really matter if, you know, I score the goal or not. But if you're like, no, I need to do this so that I can, you know, qualify for the national championship because I want to be my best self. Okay. Well, sometimes we can use our values to stress ourselves out more about things that are super important to us. That we're just like, ah, whatever, it's not that important, but in this case it's the opposite. It's not that they're telling themselves that it's super important to do really well at this little speech, It's probably more the opposite. They've actually clarified, oh, there's so many things more important in my life than this silly little speech. So who cares if I mess up the values that you have? Help put everything in context and it's super important to know like, is the thing that you're doing important to you? Well then, yeah, you should probably focus on it and stress yourself out a little bit more to get into the optimal zone. But sometimes situations are super stressful and you should focus on all the other things in your life that are important. So that it's just like, oh, it's just this little thing. This is similar to the self affirmation, like we're often focused on things that we can't control about or bad habits. Instead, if we think, well, there's all these wonderful things about me that I wouldn't want to control, and that's good, that, you know, they wouldn't want to change and that's good. Oh, then these habits, It's just like this little piece. Then it becomes just like getting a haircut or changing your clothes. So I just wanted to close with a few different ways that we can try and clarify our values. Because sometimes we get bent out of shape. You're like, I don't know what my values are. And you can't just like always figure it out directly. So sometimes we need to figure them out indirectly. I think one of the best ways, so these are some strategies that you can use, but I think one of the best ways to actually ask yourself what you are scared of, because when you're scared of something like the emotion is there, is telling you something is important here. It's just that probably whatever your brain is focusing on is about the things that you can't control and the potential negative consequences if you're dating someone you're scared of, of being heartbroken or you're not dating anyone because you're scared of being heartbroken, because you've been heartbroken before, your brain will make the choice, the simplest choice for you. It's like, oh great, well then let's just not go on any dates or not get too involved. Sort of take a passive role. And then that's the simplest, easiest way to avoid that heartbreak. But if you're like, oh, but I have that fear because it's really important to me to be in a loving relationship. Oh, then that would be stupid to avoid that fear. I'm yes, it is stressful to go on a date or to get close to someone, but I'm not choosing that for no reason just to stress myself out. I'm choosing it. Oh, Because that's deeply important to me and there's no other way to get there. So it's just the flip side of the coin and you can move through that fear. So Yeah, thank you. Hopefully you can utilize those strategies in your studying habits as well. And yeah, if you have more questions, come to office hours at 02:00 today. Otherwise, enjoy the exam. Thank you. There you go. You're welcome.

Week 5 Lecture 1

Okay. Does everyone have a good Halloween? Yeah, that's good. One person after all of that candy. We might be talking about a relevant topic of body image though. It's not just about what you're eating or your diet. This is much deeper and broader than that. We're talking about what exactly body image is and how it's shaped and this related topic of self compassion. But first, I want to focus on something we discussed this whole quarter so far but haven't really explained. We've talked about the various tuning of your neural circuits. I mentioned that in the first lecture. Some people worry, some people worry are more decisive, some people are less decisive. And you can perhaps see now that what that means is the specific neurons from the prefrontal cortex to the limbic system within the stem, maybe more or less reactive or more strongly or weakly connected. That's how that tuning is formed. But how did it get this way? Specifically in your brain and why is it different from the subtle tunings in other people's brain? And there are several forces that shape the tuning of your neural circuitry. The first they want to talk about is genetics. These are the genes in your DNA. They encode for specific proteins. The genes that you have provide a guide for how your brain is going to develop. It's the reason why everyone's brain is developed in the same way. Like unless you have some huge genetic abnormality, our brains are all basically the same. We all have the same regions, they're all connected in essentially the same way. It's just that it's important to recognize that there are other factors that are influencing this. Well, that we'll get into a moment because genes are not destiny. You can have a certain gene but it get expressed. That is the protein that it represents may not get produced. It might be upregulated or downregulated. There's all these thousands of genes. But it's not like a blueprint for a house. When you have a blueprint for a house, well, someone makes this drawing and this is how the house is going to end up and someone follows that drawing. Exactly. Your DNA is more like a sketch on a cocktail napkin about like, hey, this is how things are likely to turn out unless some stuff happens or other stuff happens. It's a propensity to develop in a certain way, but it is not a guarantee that you will end up that way. Um, but it is the first draft for how you will end up. And it has a strong influence on a lot of different key circuits. So a lot of times when it comes to genetics, we are taught about certain traits that are controlled by one gene. You have that gene, you can roll your tongue. And if you don't have a gene, you can't roll your tongue. Or if you have this gene, then you think that cilantro tastes like soap. And if you don't, it tastes good, whatever. But most traits are controlled by many genes, and the change in one isn't going to necessarily have a dramatic and obvious effect. But it can influence the development of these circuits. There's one gene that some researchers have noticed that seems particularly interesting. It has to do with the Serotonin transporter molecule. What happens in the serotonin system is Neurons that produce serotonin. This is how it works in all neurotransmitters, but specifically into serotonin neurons that produce serotonin release that serotonin into the synapse. It gets sensed by receptors that are also proteins on the postsynaptic cell. Those do stuff based on other proteins they've created. But then your body also has this protein called the serotonin transporter. Which prevents that serotonin from just sitting out there in the synapse, continuing to activate more neurons. Instead what it does is it transport, it sucks that serotonin back into the cell so that they can be released again. The most common antidepressant medications that are used today are called Selective Serotonin re uptake inhibitors or SSRI's. The way that they work is they don't increase the amount of serotonin that your body or that your brain. They just target the serotonin transporter molecule they attach onto it and block it from working as well. It doesn't remove the serotonin as quickly from the cell function or from the synapse functionally. It increases the available amount of serotonin, at least in the short term. That's how most antidepressant medications work. Some researchers noticed that, well, you have a specific gene that encodes for you, making the serotonin transporter molecule based on the specific gene that you have that you got from your parents. Uh, that transporter might be more or less efficient or that gene might be more or less efficient at that molecule. They notice that people who have this less efficient gene for creating the serotonin transporter have greater risk of developing depression. Now, it's not like this is a genetic test for depression, just a likelihood of developing depressions. If you have this gene, this less efficient version of the gene, well, it means you're more likely to get stuck in this pattern of depression than someone else. Kind of like if you have a microphone and speaker set up. Well, if some people have microphones that are more sensitive, well, those people are more likely to get stuck in this feedback loop. There are other observations that just, you know, people whose brains are more emotionally reactive also more likely to get stuck in depression. It doesn't mean it's a direct one to one. Causation just turns up the volume or increases the likelihood that it will happen. Specifically, there is a short allele. If you can think back to genetics, the different variations of the same gene are called alleles. The short allele is less efficient, the long allele is more efficient. They can test, you have a short version of the gene. They also found that when they scanned people's brains, uh, both functionally and structurally, functionally being like FMRI, what's the activity structurally, how much gray matter is there? They found that there was altered limbic system development and activity. One thing that they found is that people, this less efficient gene, had a smaller Am dill. Okay. We can see if you have the gene and we can see that you have a smaller do. This might create questions in your mind. Um, does anyone see anything that's confusing about any of the stuff that I've said? That doesn't make logical sense. Okay, it's confusing for me as well and it's just a reminder that we don't fully understand how this all fits together. And also it isn't simple, straightforward, it's very complex. We found that the researchers found that people with this less efficient gene, greater risk for developing depression, these same people also had a smaller Now, if you're like me, did you have a question? Yeah, he was less efficient actually. Serotonin transporters, does it make them more efficient? It's less efficient at creating the serotonin transporter, so you end up creating fewer of them. But that is also part of the problem, right? Like if we're saying, oh, antidepressant medications block the serotonin transporter molecule because our brains are really good at black or white thinking and we want to learn things and yes, this is good, no, this is bad. You're like, oh, okay, so it's bad to get the Serotonin out of the cell. And that's where I'm just trying to say like, nope, it's more complex than that. This is just how it works because if this gene is less efficient at creating serotonin transporter, you'd be like, wait, but then that would have the same effect as like blocking the serotonin transporter. So shouldn't they have less risk of depression? And this is where I want to say like you can't understand this logically because it is not a fully logical system. Some of these things you just have to realize like, okay, this is what it is. Clearly serotonin is somehow involved in depression. Is related to depression, but how exactly is a very complex thing? So a lot of times we're like, oh, with antidepressant medications for example, they do help with depression. Exactly how and what the mechanism is, we don't fully understand. We do know that they target the serotonin transport a molecule, but to get people to take medications because we didn't fully understand it, it's very hard to convince someone of something. We're like, I don't know, just take this. And so it's very convenient for the medical community to just explain like oh look you have too little serotonin and so we're just going to block the re uptake and then it's going to restore your proper balance of serotonin. And it's a very nice simple story. It is true in sort of some ways, but the actual story is much more complicated and we don't fully understand it. So the point here is that not very much about it. You're like, okay cool. You think really deeply about it, it doesn't make any sense, but one of the ways that it makes sense is that if you have a gene that's before you were even born, this is impacting the development of your brain when you were just a few cells. Could changing the concentration of serotonin at that point have a different effect then, you know, say taking an antidepressant medication once your brain is pretty much fully formed. Yeah, sure. So the point here is like, well there's many points but one is I would have assumed wait, shouldn't it the other gene increase risk of depression or like given everything I know like shouldn't those people have a bigger amigdla? It's like, well, development happens in many stages. You can't understand everything from one scientific study. You can only get, okay, there's something going on here. But the overall point is stated briefly succinctly here, is that it alters the development of parts of the Olympic System. That's sort of the strongest conclusion you can make. It also alters the activity or the functional communication between brain regions that people with this less efficient version have significantly less functional coupling. Or less communication between the amygdala and parts of the anterior cingulate cortex. So you know how strong that connection is is different based on whether you have this gene or not. And that maybe, and some people increases their risk for developing depression. So that's just the first element of it, the genes that you get in your DNA from your parents. But genes are not destiny. And they don't always fully make sense. They don't always have the clear effects that we think they might have. But they are clearly an important part of. Puzzle. But then there's this further complication of the experiences that you have that further shape the tuning of your neural circuits, particularly early experiences that you have in your life. Why? Because that is when your brain is most plastic, that's when it's most malluble. Interestingly, this too is not linear. You could have an experience, say as a baby, but your brain is so mallable changes a few months later, oh, then your brain adapts to that. Sometimes these early experiences might not have that big effect because if there for a short time, then your brain can adapt again while it's still malluble. Yeah. These shaping experiences based on your level of doesn't that also depend on whether or not you are in a sensitive period when it occurs? Right. Well, this concept of sensitive period, yes. Different brain regions develop at different rates. Limbic system and stratum are mostly fully formed by the time you're born. Whereas your, well, it has to be milind and your prefunal cortex is really slow to develop. There are certain time periods where you'd be more sensitive. But part of it is related to what I just said, that the sensitive periods developed from psychology. Not knowing anything specifically about the brain. Just like, oh, that's interesting, when a kid is abandoned or abused in this time period of their life, like it seems to have a blasting effect. That is that, well, it could have had an effect before that, like when they were one year old or six months old. It's just that their brain is so plastic and malleable. If they stopped, you know, being abandoned or abused or whatever after that, oh, then there maybe their brain reshaped and therefore, no harm in the long term. But that does get at these, oops, oh yeah. Early experiences, early stress and trauma, and also your relationship with your parents. These have particularly profound effects on the tuning and the further refinement of your neural circuits. As you get older, other experiences can have further effects. But in general, the things that happen the biggest, because you know the brain is already more developed as time goes on. There is a further nuance that when you enter puberty and adolescence, the brain starts to become more plastic again. And that's one of the reasons why experiences that you can have in middle school or high school can be very transformative and long lasting and an effect. The definition of early has a broad definition, but the reason these experiences can influence you is not through your DNA itself. I don't know. If you think back to like when you first learned about DNA back in middle school or high school or whatever, like before Darwin, people were like, oh, well, drafts have long necks because they kept reaching up and then you got longer. Your experiences in your life do not necesarily direct your DNA except through mutation or something. But what does happen, that it changes how your DNA gets expressed? This is called epigenetics or epigenetic modification. Your DNA, the genes that you get from your parents, it's the same in every cell. That doesn't change throughout your life. But the process of how those specific genes get turned into proteins, that is influenced a lot by your experiences. And it means that certain genes that you might have might get turned off. That binding of certain molecules means, oh, I have this gene, but it never gets turned into protein. So it's like I don't have it, or maybe you have some gene. But based on this epigenetics, it upregulates and produces more of it than would be expected. These experiences that we have, particularly attachment, which is the relationship that we have with our parents and particularly early stressors and trauma further shape the tuning of these circuits through epigenetic mechanisms. Does that make sense or any questions about that? So these are shaping your DNA might give you a tendency to have a limbic system that is emotionally reactive. But if your parents are very nurturing and caring, that might relate some of that reactivity. Or if you're an environment that's extremely dangerous or your parents have a lot of anxiety that might regulate the reactivity of those circuits. You know, there's a lot more on this because your pre fundal cortex is still developing until you're like 25. Certain areas of the Limbic system, particularly the hippocampus, are very sensitive to stress. And so long periods of chronic uncontrolled stress, particularly when you're young, can cause long term changes. You could say damage, that's like a judgmental way of looking at it, but it does cause long term changes to how your lymbic system develops. There's genetics, The genes you get from your parents, uh, there's your early experiences that further refine that. And then they're your current life circumstances. And the interesting thing, so your current life circumstances that includes your relationships and your habits and your day to day life and your job where you live. Like, all of these other factors also influence the reactivity of those circuits. That's a lot of the stuff we're talking about in this class, right? Like you might have a limbic system that's kind of reactive. But if you exercise regularly and you get good quality sleep up well, then that calms down that reactivity of your limbic system. It's just that some of these forces you don't have any direct control over, and some of them you do. You have control over your genetics. You have control over your early experiences. Because you literally cannot go back in the past and change it. You don't even have full control over your current life circumstances. The habits that are wired into your brain currently or everything that's going on right now. You do have some ability to influence those current circumstances. However, including the mindset or the mental framework that you're using to approach your life. It's true that if you're having difficulty now with anxiety or depression or other challenges, it's true that you could point to the crappy genes that you got from your parents and be like, oh, let's see, have these crappy genes, oh, you know what? I also have their crappy parenting, and if they were better parents, then I wouldn't have this problem right now. The problem with that kind of thinking isn't that it's wrong. It's that it's just you can't do anything about that. That doesn't mean that the feelings that you have as a result are invalid. They are, it's just that the only thing to do with those feelings is to acknowledge them and validate them. Treat yourself with self compassion because you can't use them. You can't change the past or those circumstances. In fact, you could even use it as a reason to treat your parents with more compassion because she's like, oh, no wonder they were such crappy parents. They had crappy teens and they were crappy parents because they had crappy parents. But This notion of what we are attributing our problems to or what we are focusing on. Well, that is something that I am doing right now in the present and that can be changed. And so there's some research that shows like it's not the actual relationship that you had with your parents that matters most in your current circumstances. It is how you view it now or how you are conceiving of it that matters most. Because if you want to blame all of your current problems on the genes that you have and the experiences you had previously, you are welcome to do that. Some people might criticize you, but I can say like no, you're welcome to do that because you're correct. It's just the only person really that's suffering from that continued mindset is you. And you're doing it because it's true, but there's millions things of things in the world that are true, that aren't helpful to focus on. Like, you could walk, um, back home from this class right now and get hit by a bus like that is true. Is that helpful? Well, it's helpful when you're crossing the street that you should look both ways. It's not helpful to think about all of the time, these ideas about how genetics and early experiences shape your life right now, are those helpful to focus on or unhelpful? Well, they're helpful to focus on if they help you take action, to do something about like, oh, maybe I should go to therapy to like actually deal with these issues. Or they're helpful if they facilitate you treating yourself with self compassion. Like oh yeah, I've gone through a lot of \*\*\*\*. Like maybe I should be nicer to myself. They are unhelpful if they just cause you to throw up your hands and like, oh, I can't do anything about it and give up. But what they are is just descriptions of reality. But how you are choosing to focus on that reality is something that you have some ability to control over in the present moment. Does that make sense that anyone have any questions about that? And this is where this notion of like a victim mentality can both be helpful and be misused. That if you are trying to understand your own condition, your own circumstances, it's helpful to realize, oh, yeah, all these forces are happening. If on the other hand you are accusing someone else of being a victim, well then you're not generally being helpful. So these factors I'm talking about are strategies you should use on yourself rather than telling other people, hey, you know what you need to do. You need to stop focusing on things that you can't control well, you know what buddy, nobody asked you. I'm just sharing all of this information so you can choose how you want to approach it yourself. I'm not telling you what to do. These are also related to the concept of body image. I should define this defined right there, as a subjective picture or mental image of your own body. The keyword there is subjective. You can't measure somebody else's body image by looking at them, by scanning them in some way. It's a subjective mental representation. You could ask them about that representation. But it is not necessarily related to what your body actually looks like. It's often related, but it's not necessarily directly related in that you could change some things about your body, but your body image might not change. Or you could change some things about your body image even if your body stays exactly the same. It's helpful to realize, sometimes we look at subjective experiences and dismiss them as somehow being less relevant. Well, they're really relevant to you. Like other people's subjective experiences. Oh, those are very easy to dismiss your own subjective experiences, you will probably feel more deeply. But this is very much related to a lot of the things we've been talking about in this class this whole time of like depression. As someone, their life could be great. From the outside. Like, what are you talking about? Why are you depressed? You have all these wonderful things going on. You're smart. You have lots of friends, you have lots of money. You have lots of opportunity. Why are you depressed? That doesn't make any sense. Well, depression is someone's subjective experience of their own life. Sometimes you could make external changes, like oh, maybe if you just had more friends or if you just found a job that you like, oh, maybe that would solve the depression. But you can't tell someone that they are not depressed simply by looking at the circumstances, the measurable circumstances of their life. Similarly, you can't tell someone that they don't have. I mean you could, but it's not helpful tell someone what their body image is like. It is their own experience of their own body. I want to include this as a topic because I know that this is very important and relevant for a lot of college students. There's a study that found that people of all genders are similarly dissatisfied with their weight. It's just that women tend to be more concerned, oh, that they weigh too much. Men tend to be concerned that, oh, they don't have enough muscle, they're not strong enough. But this is a common issue across college students. The women in general, the study found, are more overall dissatisfied with their bodies body image and how you are thinking about your body has the potential to create a lot of stress mainly due to controllability and the consequences factors like we've talked about, these three sees of stress, of certainty, controllability and consequences. And you don't necessarily have the ability to change everything about your body, but if you view that will lead to negative consequences, like people not liking you or being discriminated against. Yeah, well then you have this thing about that you can't control that. You're going to experience negative consequences that creates stress. But the way that we are thinking about it can be shifted more easily than the physical nature of your body. It's just that oftentimes we take this mental representation like, oh, what I need to do, I need to lose weight, or I need to get stronger. I need to use skin lightening cream or something about to change our physical appearance as opposed to realizing this is a mental representation. Body image is much less related to physical health than it is to an ideal sense of what a body is supposed to look like or anxiety about that. You've probably had this experience either with yourself or friends or people that you know where you can see that the body image and someone's body, they don't necessarily correlate. You probably have friends where you're like, oh, if I looked like them I would feel, you know, self conscious and the bikini. Oh, but they seem like really confident, they love their body. Or other times people are really super sensitive, like oh, I hate the way my hair looks or I hate my nose or whatever. And you're like, what are you talking about? You're gorgeous. That's just simply to illustrate this point that like, yep, they're two separate things. There's what you're perceiving about someone else or what it can be objectively measured. And then there's that own person's representation of themselves. Often those things correlate, but they don't necessarily have to. I just wanted to share this story about one of my friends that, who really helped me see this issue more starkly. When I first started working at the Brain Mapping Center, this guy joined our lab. He was a Postdoc, so he'd already got in his Phd in neuroscience. He weighed about 700 pounds. He was one of the closest friends I've had and I was like, remarkably impressive, like ah, like yes, he didn't like people discriminating against him on the basis of his weight, But he didn't think poorly of himself because he was this large. He thought of himself as beautiful. Uh, one of the other fascinating things about him. I mean, he was just very funny. He was super smart. And I remember him, one of our first conversations, he was complaining about his husband. And this was back in like 2004. And I was like, wait, but how are you married? Like that's gay marriage isn't legal yet. And he was like, oh honey, it's not gay marriage, I need to worry about, it's gay divorce at this point. And I was like, No, no, no, yeah. Okay. But like s like, how were you married? And he would just sort of like keep going on and telling all of these stories. And I was just like I was sort of tasked with like teaching them how to use the software that we're using in this lab. But it was like he was so fascinating and just and he was just like love telling and sharing all of these stories. And he went on to say that he was in the movie Coming to America. They didn't want to see that Eddie Murphy movie Coming to America. They just came out of the sequel, Coming to America. And I remembered seeing this movie in my childhood and I was like, oh, like, who were you in it? Because there was a lot of large black men, most of them are played by Eddie Murphy, you know, in a fat suit. And he was describing this one scene where he's like, I introduced the dancers at the beginning and I could remember this. And I was like, oh, you sang the song? And he's like, no, no, no. I was the one who pushed my way through the dancers and I could remember the scene very specifically, even though I hadn't seen the movie in 20 years and I was like, oh no, weep, that was a woman, it wasn't. He's like, oh honey, I was a drag queen back then. And he's like, oh, that explained how he got married because he didn't really mean that he was a drag queen. He lived as a woman for about 20 years. He got his driver's license and he was one of the most fascinating people they've ever known. Unfortunately, he died a few years ago. He left behind a remarkable memoir called The Gift of Rage, that I'm trying to go through and see if I can somehow get it published because he led a fascinating life. But I mean, he also shared a lot of these ideas about the body image isn't just a matter of like, you know, the shape of your body, you know, overall. Like sometimes it can be specific body parts. Like people can be very dissatisfied with their, you know, nose or their ears. He enjoyed being large because he's like, oh, it makes my breasts, you know, look so much better. He did experience a lot of racism and discrimination on the basis of his dark skin. Like even from his family who were much later much lighter skin. So this notion of body image encapsulates all these different things. From the shape of particular body parts to your skin color, to the texture of your hair, whatever it is. And it's just so crucial to master this topic because like, well, this is the body that you have, so you could feel free to hate it if you want. It might not be beneficial to you in the long term, but you can learn to have a positive image of it, regardless of what other people think about you or how other people might discriminate or criticize you. Now, how you arrive at that body image is based on a lot of factors. Certainly it's related to the factors of, you know, how your whole brain overall is formed. But when it comes to body image specifically, researchers have described what they call the influence model of body image. This makes it sound a lot more complicated than it actually is 33 parts of this, in that these three parts of these three factors directly shape your body image, the influence it. Intermediary steps. By the way, if you want to read more about Billy's story, you can go to the gift of Age.com That's what I'm trying to get publish. If you want to read the first chapter of his memoir, what are they saying? Yeah, so these three parts that largely influence your conception of yourself are your peers. How your peers treat you and interact with you are also yours. How your parents treat you, how they used to treat you, how they treat themselves, as well as information that we get from the media and just general commentary currently and throughout our lives. And we can summarize those three factors, or those three parts, as socio cultural influences. Those three formative influences or sociocultural influences in the comparisons that we make between our body and other people's body. And they also influence the internalized ideal that we have of what a body is supposed to look like. You know what a beautiful or valued body is supposed to look like? You know, you may not naturally be conscious of it, but you've internalized some idea of like, oh yeah, the body is supposed to be this thin or this muscular. Have this type of hair, this type of skin tone or this type of shape or whatever it is. So these sociocultural, formative influence is influence both the comparisons that we make. They influence the internalized ideal that you have of beauty. And those two factors are what lead to your current body image or dissatisfaction with your body image. Uh, and those two influences also can affect each other, but just to spell that out a little bit more, the comparisons that we make are the direct comparisons with other people's bodies or, you know, either in person or ones we see on TV or in magazines. We're not necessarily doing this consciously, but just that, oh, you look at someone, you're like, oh, I like her hair, and therefore, I don't like my hair as much. We're like, oh, I love the way that looks on her. Him or oh, that guy's so muscular. Whatever it is, we are looking at other people's bodies, whether you're appreciating or not. If you're comparing it to your body, that can sometimes lead to problems. Those are called direct comparisons. The internalization of the beat beauty ideal is what he is referred to as an indirect comparison that, okay, you have built up in your mind, whether conscious or not, of what your ideal body is. And so you're constantly have the potential to compare your own body to this idealized version of a body. And that's what the internal indirect comparisons do. Research shows that in men, they're often frequently comparing themselves to athletes because these are sort of the images that we are shown of like, oh, these are the men that we're supposed to, you know, celebrate and it's like, oh I want to be celebrated too. Like it's very common to do comparisons for those in women. They were much more likely to compare themselves to their best friend and that had a strong influence like sometimes that could be beneficial to you or negative to you. But it's just these were trends that they found they may or may not apply to your specific situation. Basically, one of the things I like to share about the science is like science can't tell you exactly about your experience, but it can give you some things to think about or think, Oh yeah, reflect on. Oh, yeah, that is kind of my experience Or like, oh, that doesn't really apply to me or I, you know. To be able to think about this in a more nuanced way. But we can't just like take the science and say, oh, this defines my experience. The science is correct and useful. It just, it's not the full story that defines your experience. This study wanted to look at what's happening in the brain when we do the direct comparisons. And they took healthy women 16, 35, and had them view pictures of models, female models, because FMRI always requires the contrast between two conditions. They said, okay, well we want some other image that they could be looking at critically that also has aesthetic qualities that they like or don't like. And so they used interior design just as a control condition. So they showed you pictures of interior design and be like, do you like this, do you not like this? You implicitly comparing it to know whether consciously or not you're comparing it to your own living situation. Oh, I love that apartment. Oh, my apartment's better. Whatever, it's a comparison. But when they do the body comparison, everything is the same as like this is something of yours that you're comparing to this picture. It's just that one factor they're controlling for. Are we talking about bodies? Are we talking about design? And specifically, they were showing pictures of these female models. It triggered increase in anxiety in these women. This is just anxiety as measured through a questionnaire. What was happening in the brain is three specific regions were involved. For one, they saw increased activity in the anterior cingulate cortex that correlated with the, the increased anxiety they were experiencing. This makes sense from the view that like, oh, the intersingulatean there's different explanations, but one that makes sense is that intersingulate notices mistakes. In this case, it's likely if you see this idealized version of what you think a body is supposed to look like. Might make you reflect on yourself as being a mistake or somehow in error. It also showed increases in Migdal reactivity. Because we think about the consequences perhaps of looking like we do are, oh, wouldn't be so much nicer to look like her. But this increase in migdal reactivity is not surprising that it is corresponding with increased anxiety. The other piece of this was they also saw increased dorsal stratum activity, which is not surprising because when we experience anxiety, we automatically activate the dorsal stratum to try and deal with that anxiety. You know, the habits, the specific coping habits that we activate might not be helpful in the long term for dealing with that anxiety. Like we might trigger worrying habits which kind of help but don't fully solve the problem. Or we might, you know, start planning for how we need to exercise more or whatever which helps us feel more in control of the situation, but doesn't fundamentally solve the problem. Because this problem isn't one about what our body actually looks like, it's one about how we feel about our body. And I think this topic is also really important to address because a lot of times guys like to sort of joke or criticize women for being more self conscious of their bodies. And I would just like to show you some of these socio cultural influences and see if you notice any trends between these sort of pairs of famous fictional characters from Game of Thrones. Um, Modern Family. I don't know which Kevin James show that is, but Kevin James is in a lot of different shows. Does anyone notice any trends across this? Yes. Very thin wife with a heavier set, right? It's not like, oh, these are just like, you know, a pretty ideal guy. Oh, they're like heavier set guys. Not whether or not you should look that way or not, there's no judgment. This is just a descriptive description of their appearance. This is often what we've been shown throughout our lives as what is. Normal, as my friend Bill used to say, normal is just another word for common. I would prefer to be extraordinary. But we are shown, oh, this is what's normal, or this is what's expected or this is what's good. And these are influences that we've experienced throughout our lives from the media. We also experience, you know, what our comments they say to us about our bodies or how, you know, your parents might be very complimentary of you, but you kind of get the sense that based on their comments about other people that they may be very judgmental about This is the way the bodies are supposed to look, and they're just not telling you or being honest with you about your body. The reason why this is important is because if you look at, I don't know, Marge Wilma Flintstone here, Like this is much more challenging, if not impossible to look like, as opposed to this or this or this. I bet if everyone here, if you really wanted to, you would find it much easier to look like what's his name, Brathian or Homer Simpson. Like you could do that, I believe in you. If you wanted to, it would be much more challenging to reach the sort of thin, idealized version. And that comes into the controllability aspect like, yeah, no wonder there's more anxiety about looking in a particular way if the way that you're trying to look is more impossible to attain. So that's why it's so important to understand these cultural influences. This study want to look at like, oh, well what if we expose men to more unrealistic influences? Would that increase their anxiety or their body dissatisfaction? And so they took men and had them watch reruns of Not Let's Make a deal, what's this show? Family Feud. And interspersed they told them like, hey, we're just going to watch Family Feud. And you know, we're going to ask you some questions. The actual study was in the commercials in between where some of them were randomized to have commercials of like Terry Cruz selling body spray or whatever. And others had non body image related commercials. So the commercials were either related to appearance or not related to appearance. And before they did this study, they asked them about, you know, their dissatisfaction with their, you know, muscles or their levels of depression. Then they did this study and they found that just from this small little study of just showing you a few commercials that you're not even really paying attention to based on, you know, appearance. Well, that significantly increased their dissatisfaction with their own muscles and their own body and it increased their experiences of depression. So it's just important to understand like, oh, historically men just haven't been as exposed to as many unrealistic ideals. Although the media is catching up because you realize like, oh, we can make man insecure too, to sell them things. So it's just helpful to recognize, oh, these things are going to influence you. Being conscientious of it doesn't naturally stop it from influencing you. It just helps you, oh, notice it, and maybe reframe it, or change the automatic thinking habits you have. It may also help you be more compassionate towards other people who may be targeted or may be influenced more. Because it's not just what we're shown about what's common. It's also about the consequences of, it's not just about the controllability, it's also about potential consequences of looking a particular way. And so it makes sense why some people would be worried about, say, losing weight. Because this study from Germany showed that thinner people actually make more money. This is just a correlation, but this is the average sort of monthly salary in Euros, and this is the weight relative to the group mean. And the people who weighed the least made the most money. Which kind of? Sucks. But it sucks even more because actually that was just the women, the men in the study is like, oh, well actually the men had sort of the opposite correlation. That the men who were heavier actually made more money, which would show, oh, no wonder the women have more anxiety about losing weight. Because it can have potentially have real world impacts. Yeah, maybe it's like greater weight. It's greater salary for men because as you're taller, you're heavier. Maybe that shows that height men leads to greater wages. Whereas for women that lower he factor. Yeah, Right. So that's an excellent way of thinking critically about this because as I've told you many times, correlation does not imply causation. So I just showed you a correlation between these two things and I told you a story. That story may or may not be true, you should think critically about it. But it could be that oh, well there's some other factor outside that's influencing and that's causing both of these variables. But also it could be. So that's one critical thinking example of another alternative hypothesis. It could also be, it goes the other way, that when women make more money, oh, well then they have, you know, they can spend more on losing weight or, you know, a physical trainer or whatever, and they can spend more money on losing weight. And men, oh, maybe they just get fat or, you know, maybe they go to the gym more and then the causation is the other way. Either way though, the question is like, okay, but why would they be doing this unless they believe there's some sort of consequence around it? This other study was also correlational. But it was correlational because they're not telling some people to gain weight, they're not changing anything about it, they're just measuring. This study was done in the US over the course of 25 years because this first one was just a snapshot of people at a specific time in their life. This one looked at people over time and they found that, well, how much you weighed at the two different times correlated with how much money you made at the two different times. It's just that this correlation was positive for men and negative for women. And it could be that either, well, if women gained weight they made less money. Or it could be, oh, when women make more money, they tend to lose weight. And the reverse is true of the men. Why that is the case? Well, it's probably related to a lot of larger, bigger picture issues. You could try and argue, oh, it's just purely genetic. You know, genetics might play a factor, but it's just one of many factors. And we know for certain say from the Terry Cruz City that even very brief exposures to these unrealistic images can have a dramatic effect on our images. And so a lot of times for all of these things, there are many factors. So just be a little skeptical when someone tells you they're very simple explanation, oh, it's totally genetic or, you know, women are just that way or whatever. Was there a question back there or you just stretch it? Ah, okay, cool. The body image can be different and sense of body satisfaction can be different across cultures. This study was done on send more than 7,000 individuals in ten regions around the world. And asked people about their body size. Female body, they give them, oh, number one through nine, like pick what you think is the ideal way for a woman to look. And there were a few factors that came out from this research. One, they found that less socio economically developed societies idealized heavier figures. So if you're like living in a place that doesn't have as much access to food, you're more likely to say, oh yeah, the ideal is like a seven or an eight. If you're living in a place that's more socioeconomically developed, well then you're more likely to say it's something lower. They found it was different for men versus women. They were asking about women's. The ideal body size for a woman on average men's, for a woman was larger than women's perceived ideal. So that's good news, at least if you're heterosexual, that you know, if you're a heterosexual woman you might be, oh great, like there's less pressure than the media might be pit attracting a man if that's your goal. Uh, there are several other factors that also played a role. The more dissatisfaction that people had with their own bodies that had a negative correlation. Meaning the more dissatisfied I am with my own body, that number goes up. Then further down on the scale, I'm likely to think the idealized version is going to be and you know which direction that correlation goes, could go either way. It's like, yeah, the ideal is super thin and that's harder to attain. Then I'm more likely to be dissatisfied with my own body. I think one of the most interesting ones is Western media exposure. The more we're exposed to the sort of commercials that we are inundated with in the US, that shifts people's perception towards being much thinner of what the ideal body should look like. Some good news in this is that as you get older, well, people have a more attainable view of what an ideal body should look like. Uh, and also like, as people tend to get larger, they also have a higher view, a heavier view of what the ideal body should look like. So that's at least good, but it doesn't necessarily over outweigh, you know, pun into these other factors. Now, how we experience our own body comes in a variety of forms, but one of them is something called interreceptive awareness, which is closely related to what's happening in the insula. This is how we perceive what is going on in our bodies. I want to be clear when I'm talking about body here. We're not talking about what people actually look like or what your diet is, but, you know, how is it that we perceive ourselves at all? Well, it's through what's happening in the insula and our ability to notice our own body's internal signals so we can see what we look like in a mirror. Those are visual input, but the intericeptive input of when you're thirsty, you're hungry or in pain, or your heart is beating rapidly because you're anxious. That's called interreceptive awareness. There's this interesting relationship in that people with eating disorders often have disrupted interoceptive awareness. They may also have differences in their idealized body or their body dissatisfaction, but this is something that you can practice right now. Just to notice your own interoceptive awareness, just sit there for a moment not touching yourself. And just see if you can notice your own heart beat. So this was a study they did on people. They asked them, you know, they could measure their heartbeat and then they could ask them to count their heartbeat. And, you know, they can see how accurate you are. And if you aren't accurate at being able to sense your own heartbeat, that just shows, oh, you have lower inter receptive awareness. There's nothing inherently wrong with having lower interoceptive awareness, just like with any other sense or reactivity of your brain. It's just that, ah, people who have lower interoceptive awareness might find it easier to have. Disordered eating. If you have really negative body dissatisfaction or high body dissatisfaction, you have low interceptive awareness. We then your body might be telling you, oh, hey, you need to eat. But your body dissatisfaction is creating this anxiety about eating. If you have low intericeptivewareness, it might be like, oh, it might be easier to ignore those signals coming from your body. There's also other aspects, not just body shape, of this issue, but can relate to specific body parts that cause anxiety. There is this disorder called body dysmorphic disorder. It's studied by one of the big researchers into it is here at UCLA. His name is Jamie Foner, He published this paper. What body dysmorphic disorder is, is not about general dissatisfaction with your body. It's about si, dissatisfaction and anxiety, and negative feelings with a particular part. That specific part varies from different people. With body dysmorphic disorder, it is not necessarily correlated to anything else that anyone else could perceive. I remember hearing Dr. Fuszner talk in this auditorium about bodysmorphic disorder, and he said when he first started studying it, people would come into his office and he would kind of try and guess in his own head like, oh, what part of their body they were preoccupied with or that was creating a lot of anxiety. And they would say like, oh, I just hate the way my nose looks. And he sort of joked, oh, in his own head, he'd be like, oh, your nose looks fine. I'd be more worried about your ears. It's just a joke. Doesn't actually treat people that way. But the point is that like someone could be very preoccupied with how their nose looks and feel that their nose looks bad. That people are paying attention to it, they often get surgery for it. People with body dysmorphic disorder might frequent a plastic surgeons office just trying to get the right look for their nose or their ears, or whatever part of their body they're preoccupied with. Sometimes this disorder is highly prevalent in body builders who just have a preoccupations like, oh my biceps just aren't big enough, you might look at them, Oh my god, your biceps are huge. But for whatever reason, they are just not perceiving it. It is their subjective representation of one part of their body. There's something wrong with it. When you put people with body dysmorphic disorder in an FMRI scanner and show them their own body as it looks, they will have increased activity in a few different regions. Date that's part of the dorsal stratum and that's because, right, well it's creating anxiety. And that anxiety is activating automatic habits. But also one of the biggest things they see is changes in the anterior cingulate cortex. Because again, these people are looking at what they actually look like, but their brain is registering that as wrong. That's a mistake. My nose shouldn't look like that. I have an idea of what my nose should look like, and I need to keep taking action until it looks like that. Or I have an idea of what my shoulders or my biceps should look like. I need to keep doing something about it until that error is corrected. They also saw changes in the visual cortex, just like at a very basic level of how their brain was perceiving themselves, being influenced by that anxiety, as well as the orbit of frontal cortex, which plays a big role in motivation because they were motivated to do something about it. This brings me to this idea of pride and shame and how these emotions are very much related to our body image. Because it's not just a representation of what I look like or don't look like. It's about what I should or should not look like and what is good or bad to look like. This particular study, they were looking at body image at all. But they wanted to see like what parts of the brain are active when people have these sort of self referential emotions, Meaning that oh, when I think about myself, I'm like, oh, that's good, I feel proud, or ooh, that's bad, I feel ashamed or guilty. And so they had, they prompted them with specific memories that these people had shared to elicit feelings of shame or pride, and so on. They found that pride and shame both increased insula, reactivity. It activates stuff in your body. Creates intericeptive awareness. When you have strong emotions, you feel things like you may feel good, you may feel bad, but it's certainly creating things, sensations in your body that are processed in the insula. That's interceptive awareness. Both of them. Increased activity in the Dorso medial prefrontal cortex. Because these are things the self referential thinking that we are thinking about ourselves. That's what the Dorsomedal prefrontal cortex says. But what was very strange is that both pride and shame, increased nucleus succumbents activity. And this is sort of like the reward part of the brain, the learning part of the brain that is somehow rewarding or reinforcing to heap shame upon ourselves. That doesn't make a lot of sense, like why would it increase the nucleus sucumbens activity unless you look at what is going on in the Amigdola. Okay, we can experience pride and feel like, oh, that's good, I feel good about that and get reward from that. That makes more direct sense. But then we're like, but why does that increase the Mig delivery activity? Well, that could be excitement or it could be the fact that we, when you're feeling really good about yourself, now you're at risk of someone undercutting. You say yeah, you're not that special. Oh, you're not that good in many ways. Like, the better you feel, the more likely you are to have anxiety that something could go wrong, that something bad could happen. The inverse is sort of happening with shame, that if something bad has happened or we did something bad and we feel guilty, you're shamed. And we punish ourselves about it, for how we're feeling. Well, that is rewarding because it decreases a migdular reactivity. They're like, I don't need to worry about somebody else punishing me. I've already punished myself. This is one of the reasons why it is a spiral that we can get stuck in. We do it because it helps us feel anxiety. It's just similar to worry, not the best way to deal with that anxiety. And it often keeps us stuck in this sort of same spiral, where if we tried to treat ourselves with more compassion, then we would feel more anxiety, which would just trigger the habit of trying to be ashamed of ourselves. This brings me to my favorite quote from a scientific study that is about helping people with morbid obesity, like Billy lose massive amounts of weight. And something my friend Billy told me that never really understood. He's like, it's not about calories, it's it's about emotions. He's like, I he had horrible abuse as a child. And he's like, the only thing that helps me feel safe is eating food. And so I could just not eat food. But then, you know, then my depression or anxiety gets worse. And what they found in this particular study was like, okay, you can get people to lose weight just like bring them into a hospital, restrict their calories, make sure you know, the electrolytes don't get out of balance. Like you can reliably get people to lose like 200 pounds over six months under tightly controlled conditions. The problem is that when you let people out into their normal lives, 70% of them gain all the weight back. And what these researchers realize is like so many doctors are looking at this is like, why are these people doing this thing to them? It's so bad for them. And what these researchers ask is like, oh, well, let's flip that on its head. Obviously, gaining weight or eating food must be so extremely beneficial to these people that they continue to do it even though it's causing these negative consequences. And what they found is the two biggest factors that predicted whether someone gained back all of the weight were a history of childhood abuse or being in a currently abusive relationship. And it's like, because those two things we don't have direct control over and they create lots of anxiety and shame. And it just so happens that eating food, oh well, it helps you feel, Homer, it pushes you into that parasympathetic balance. It's just that it doesn't quite solve the problem, but it almost works. And what they said in this article is that it's hard to get enough of something that works because it almost works. And so that will rewire your brain to keep doing it and keep doing it, because it doesn't fundamentally solve the problem. And I'll just end just briefly on this study, I can come back to it later, that self compassion is the way out. What we're trying to often accomplish is just to be loved and accepted by other people. But that's sometimes hard and risky and you have to start with yourself because you're fundamentally starting with this point of view that you are unloved or unlovable. Then your brain's going to find ways to deal with that that aren't necessarily in your own best interests. And if you can treat yourself with more compassion, then it leads to decreased anxiety, decreased stress, improve positive emotions, and also improvements in your own body image. So I'd encourage you to treat yourself with more compassion. This week's intervention isn't directly about compassion, but it's just about have a phone call with someone. Hopefully your TA's explain this in section, but just on three different days, call someone who you don't normally talk to and just have a conversation. If you're not sure what to say or it's awkward, you can only say, hey, my professor assigned me to call someone I thought of you great like, but someone you don't normally talk to on a regular basis. So you go through your phone and call your old high school friends or ex girlfriends or whatever, and I hope you can treat yourself compassionately as you do. So. Thank you. You're welcome. Thank you.

Week 5 Lecture 2 (Lecture 10)

Okay, I just wanted to go back over the last few slides. Oops, the last few slides from last time. Yeah, yeah. The study that I talked about where they got people to lose a lot of weight consistently over six months, but found out that most of them gain the weight back. The key takeaway here is that the bad habits that we fall into, or the ones that seem so readily apparent in other people's lives, well, you have same bad habits, they just might be different ones. But you have the same patterns of bad habits that you fall into. Bad habits. I say they help you do them because they help you. That is how habits get wired in the brain and you continue to do them because they continue to help you. It's just that the ways that they get in our way or cause further problems present a longer term challenge. But then we fall back on the same habit because it helps us deal with the consequences of what that habit created for us. We do it a close approximation to the goal that we're trying to accomplish. If you're, for example, trying to be successful, well, that's really hard to define. It's really hard to measure. It's much easier to focus on making money. It's a good proxy for it. It's close enough. They kind of align with each other, but it doesn't capture what you're really trying to accomplish, which is, I mean, maybe you only care about money, but for many people, it doesn't quite accomplish what they're trying to do, which is successful or have an impact or help people. But it's easier to focus on. The dopamine system will draw your attention towards, say, making money, but that won't ever get you to your true goal. It's hard to get enough of something that almost works. And this is why many people can have unhelpful relationships with money where you make money and then you make more money and you keep making more money because it's, it is what you want. But it's quite, and when it's not quite then it's basically impossible to get enough of it because it's not actually satisfying your deeper need. And this is true in addiction. It's true with a lot of bad habits that we get into because they are our best attempt to get at what is most important to us. And a lot of times when there are issues with body image. But this is also true of a lot of different bad habits. What we're really deeply trying to accomplish is to just be loved and accepted for who we are. And that is a scary proposition because it's so crucially important and it's unclear sometimes how we should go about that. And so we settle for kind of like, well, a close approximation. Whether it's, you know, I can't find love and acceptance. But oh, like food kind of gives me that same sense of comfort. Or I can't find connection, you know, deeper connection with people. But like getting a lot of likes on Tiktok that kind of scratches the same itch. But it's very hard to get enough of something that almost works when it's not quite the right thing. And this is why this idea of self compassion is so much larger than just body image. Yes, it helps with body image, but it really helps with a lot of habits that we fall into that we don't like. Because we're often trying to accomplish one of the deepest fundamental human needs to be loved and accepted. But if you don't love and accept yourself as you are, then it's very difficult to find it from somewhere else. Because even when we want to be accepted by other people, that's also just an approximation for what we want. Well, being popular is an approximation for that love and acceptance or Being in a loving relationship now is an approximation for the love and acceptance that you wish your parents gave you. But it doesn't quite line up and therefore that need is somewhat insatiable. So it's helpful to start of the source by just treating yourself with more compassion. When you treat yourself more compassionately, it's easier to high self esteem because you're not undercutting yourself. So often people with more self compassion have better body image. Again, this is not correlated with weight. They just appreciate their bodies more. Practice self compassion on a daily basis, then it correlates with increases in body image and appreciation. This study looked at this daily diary of having people practice self compassion. And see how that correlated with body image and eating behaviors in female college students potentially applicable to your situation. They found that when they look between people, people were more compassionate, self compassionate than other people. And those people who are more compassionate had better or higher than average levels of body image and eating behaviors that they wanted to do over the course of the week. And from that perspective, you could say, ah, well that's just between people comparison. That doesn't necessarily mean we should I change your behavior? Like oh, if we look at basketball players all around the world, there's this like well some people are really Conduk, a lot people are really good basketball players. Like well, that's not a helpful necessarily to know that oh, you know, someone is 66 and they can dunk. So therefore I should dunk like I'm not going to be able to dunk. So between person comparisons aren't always helpful, but what they also found when you looked at within a given person over time, that day to day fluctuations within a given person in self compassion contributed to day to day fluctuations in body image and eating behaviors. So basically this idea of the behaviors that you engage in and the body images that you have aren't just from this sort of average level of being a generally self compassionate person. But also in particular that on any given day, treating yourself more compassionately gives you boosts in these other areas. Basically, after I wrote the book and I started doing this class, I started doing personal coaching. And I realize that this is one of the most fundamental issues that people face. Because if you're a smart goal oriented person who has emotions or who cares about more than just themselves and isn't a narcissist, you tend to get stuck in particular ways. I imagine that applies to most of you in this class. But one of the things when we're goal oriented is we want to accomplish goals. But most of you, by virtue of being here at UCLA, it means that high school wasn't that difficult for you, at least academically. Like you're smart, you were able to do it. And that means that if you think about the Yorkies Dodson curve, well, in high school if you didn't do as well, it's probably because you weren't stressing out enough. Because it was easy and you needed to focus and get yourself on track. And so it was a helpful habit to criticize yourself to be, oh, stop slacking up, stop being lazy. And that pushed you into this ideal level of stress on the Yorkies Dodson curve. But now in college, where the challenges are greater, you're at the top public university in the country, the challenges are greater, the uncertainty is greater, the potential impact for the rest of your life is greater. And now maybe you're a little further on the unhelpful side of the Yuki's Dodson curve. But we fall back on the same habits of self criticism because we've wired those into our brain because they are helpful. It's just. At some point you can have the self awareness to recognize. Ah, is this helpful? Right at this particular moment, I know I'm doing it because it's familiar. But is it helpful or is it just stressing me out unnecessarily? And I'm holding myself accountable or trying to punish myself for things that I don't have control over. And therefore, being self compassionate is not just lowering your standards. It means being able to stop punishing yourself unnecessarily for things you don't have control over. And to start actually holding yourself accountable for the important things that you do actually have control over. So I hope you found that U phone call intervention helpful. Oops, this is the wrong one. Seven, sorry. I'm just looking for today's lecture from self compassion. And this topic marks a transition in, not just because it's after the mid term and now all the stuff is going to be on final. The first part of this course was all focus individually on stuff that you could do personally. Oh, I need to change my exercise levels, or I can sleep better. I can treat myself more compassionately. And so I can practice gratitude. I can meditate. As we go into the second half of the quarter, we're more focused on other people. And specifically our relationship with other people and self compassion and body image sort of is like, oh, a nice bridge between those two because they are so much intertwined. But today we're going to be talking about the social aspects of neuroscience. And how we connect with other people and why that's so important. And I'm going to start with this image of ducks. There's a great Youtube video at this link that you can watch at some point. But one of the fun things to watch about ducks, there are a lot of bird species, is that the little ducklings just like follow the mama duck around. And like wherever the mama duck goes, they go. And it's adorable. They do this because of something called imprinting, which is not going to be on the exam because it's not how the human brain works. But I just wanted to illustrate this as a distinction. It's crucially important for the baby bird to be taken care of by the mama bird because it can't take care of itself. That's why species take care of their offspring. It needs to learn how to fly. It needs to learn where the food is. It needs to learn to stay from danger. But that's really complex, and in the bird brain, nature figured out a really simple workaround where when the baby is born or when it's hatched at some very short critical period, whatever big object it sees that is moving around, it decides, oh, that's what I'm going to follow. And usually that's the mother, because the mother's sitting on the eggs and eggs hatch and they see the mother. Oh great. And that is really a really helpful trick for survival because it overcomes a lot of complexities and uncertainties. It's like God, just follow the mother and you'll be fine. Scientists have discovered this trick and you can get baby ducklings or geese to imprint on some other object or person like bouncing ball or a person. They'll follow that around like it's just their instinct. In humans though, the process is much more complicated because our brains are more complicated, but also how we exists in the world is different. It's not sufficient just to be like, oh, this is the person that gave birth to me. Or this is the first I see moving around, I will trust them implicitly. No matter what. In Malian species, children form their relationship with their parents slowly over time. And it's more nuanced. And this is because humans are a social species. We rely on each other to not just reproduce, but to survive and thrive. Uh, we evolved in groups. Ducks, you know, they can spend a lot of their time on their own. A lot of species that are on their own, humans evolved in groups. In fact, there's a lot of evidence that says the reason that our brains got so big over the last few hundred thousand years is because it allowed us to more effectively engage in those groups and manage our complex social networks. And this allowed groups of humans who could interact and support and connect each other to thrive and reproduce and survive more than their closely related cousins who didn't have that capacity in our brains. Allowed us to be social. And being social allowed us to specialize. It allowed us to get more food to support all of this complex brain machinery that we had. So one of the questions though is like, well, how did that come about? Because one of the things that happens in evolution is it, it tries to use whatever already exists to make happen, whatever the evolutionary pressures are. So there was a sort of natural selection towards, oh, well, if you can trust and interact with and connect with a larger group of people beyond just your family, well, then we can get more food. We can compete better, we can protect each other more. Evolution relied on two pre existing mechanisms to facilitate that. You can think of them as a carrot and a stick. It first the carrot, it relied on reward circuitry that already existed in the brain for other things like eating food or even having sex or whatever. Whatever reward circuitry tried to get us to reinforce us doing. And essentially it's like oh, well you just use that same reward circuitry to make it like enjoyable and rewarding to cooperate with other people or to trust other people, or to just be close to them or just have physical, non sexual contact. And then there's also the stick where your brain is like, oh, well we could use this like pain and fear circuitry that already exists and just apply it to social relationships as well. So we'll make it really scary to experience isolation or painful to experience social rejection or really anxiety inducing to think about social rejection or to be embarrassed or, or whatever. And those two circuits in the brain that already existed for other things, oh, well we can co, opt them to make it so that we want to interact with each other, both because it's enjoyable and to avoid the fear and pain of isolation. Because both of those will help facilitate us working in groups, which helps our survival and ability to reproduce, which is the only thing that evolution cares about. Now, this notion that our, um, our survival depends on each other, it isn't just about like, oh yeah, because you need food and more people can gather more food, though, that is a key part of it. It's not just about protection. Like, oh, well there's a bear and if we have ten people with spears, then they can fight off the bear, though that also is part of it. But our very brain development depends on our ability to connect with others, particularly with our parents or caregiver, someone who cares about us and takes care of us from a young age. Usually that's the parents, but it doesn't have to be. Some of the research came on this from a very unfortunate circumstance, where in the late '60s and '70s in Romania, both contraception and abortion were outlawed, which not surprisingly, led to a huge explosion in the number of unwanted children. Who were then frequently abandoned in the state run orphanages. And so they had these huge, state run institutions and these people who didn't want their children, so they left them at the orphanage. And whether it was their thinking at the time or just their, you know, lack of resources to care for all these children, they didn't have a warm loving experience like they had one person taking care of, you know, 1015 babies. I don't know what the exact ratio was, but there wasn't a lot of cuddling and nurturing. They're like, okay, well we just have to keep these babies alive. Okay. So we make sure they get enough water and food and we'll change their diaper and because at that age, baby's kind of like a plant, right? They just need a few nutrients and boom, boom, boom, like they'll survive. But what they found is a lot of the babies did not survive, and even the ones who survived, their brains did not develop in the same way as children who were raised in more traditional homes. And so much later they did some MRI scans of people and they found that children who are raised in these institutionalized settings in Romania had significantly less gray matter in their brain than people who are not raised in those kinds of settings. 15% the development of the brain just didn't progress in the same way. And this is just the people who survived. Many people did not survive. This is an example when you look at just more broadly, instead of this institutional, Romanian specific story, just look at the circumstances of extreme neglect. It's a terrible thing to think about, but you know some children, parents don't take care of them sufficiently and their brains just don't fully develop, even if they are able to survive. So this is a normally developing three year old brain. And this is the brain of a three year old who experienced extreme neglect. And one thing you'll notice is just beside difference, right? This one's a lot bigger. You also notice like these things, here are the ventricles, this is where the cerebral spinal fluid is. They appear to be a lot bigger because all of the gray matter around it that would be filling up that space is much smaller. They also found in the study of Romanian orphanages, that those children or those people had much larger relative size of the Amigdola. This experience of how they rays affected the development of their limbic system. When we think about a human, baby is like a plant. It is not sufficient to just give it water and food. It literally also needs not necessarily love, but at least something close enough. A physical contact, probably eye contact, interaction with other people, or it will not either survive or it won't develop as expected. Another way of thinking about this is, oh, it is similar to a plant in that way. It needs just a combination of certain chemicals to survive. It's just that certain chemicals that the brain needs to survive and develop. One, produced not by sunlight or food. They get produced in the brain by these specific types of human interaction. By snuggling, cuddling, feeding, all of these wonderful things. And we'll talk more about what those are and what those chemicals are produced in the brain. But also I wanted to talk a little bit more about the stick concept that I mentioned earlier of how we had all these mechanisms for pain and fear. And so the brain was like, oh great, we'll just use the same mechanisms to make people scared of social rejection. This idea was something that was studied recently in an MRI research study where they used this stupid little game called Cyberball, which is the dumbest video game you could play, I mean It's probably more interesting than some video games you could play. But it's a very dumb little video games based on this idea to try and study what's happening in the brain when we experience social rejection and the way the game works. This is the illustration of it. I mean, computer graphics weren't as good like 1015 years ago whenever this study was conducted. But basically, you would go inside an FMRI machine, They scan your brain, you look at a computer screen, and you're playing this game of Catch with two other players. There's other people who aren't being scanned but are playing this video game with you and other computers. You're this little hand there in the middle and these three players, you're all just playing catch. Super fun. Whenever you're ready to catch the ball, you just kind of like raise your hand, You point it at the person who has the ball and they can throw it to you and you can throw it to them and they can throw it to each other. Super fun. But the purpose of this game was not to be a fun video game. Uh, as you hopefully al right, at least I don't think it was, that was the full intention. But the purpose of it was to see what would happen in your brain if the other two people just ignored you. They all of a sudden stopped throwing the ball to you. They ignored you, and they just threw the ball back and forth with each other no matter how much you were like, oh, hey, I'm open. Oh yes, throw it to me as is illustrated in this little clip. So the start of it, oh, you're throwing the ball, it's super fun. And then all of a sudden at some point they ignore you and just throw the ball back and forth to each other. And this seemingly little tweak is enough to elicit feelings of social rejection and making it feel like you were being ignored. What They didn't tell participants what participants believed. They believed that it was two other people just like them playing the video game and were deliberately ignoring them. What it actually was? Well, there were no other people at all. It was just the computer program and it just flipped a switch and stop throwing the ball to you. But just this small rejection elicited feelings of social rejection that hurt and felt painful. And that's not just a metaphor. It actually activated the same brain regions that responds to physical pain. If you are trying to hammer nail in and you hit your thumb or you stub your toe or you cut yourself or whatever. One of the primary regions that activates is the dorsal, anterior cingulate cortex. This is the same region that activates when we notice mistakes. Pain is a great example of a mistake because it's your brain saying whatever you're doing, like stop that. And this is a great motivator. It gets us to stop hurting ourselves. It often correlates in physical pain when we're doing physical damage to ourselves. And our brain is trying to draw our attention to that and like, hey, stop doing whatever you're doing. That same brain region is activated when we experience social rejection, even these small little bits of social rejection. And they found in a followup study that if before they had people do this cyberball experiment, they gave them the opportunity to get some social support. Either from, you know, calling someone they knew or, you know, maybe just the researcher in the study telling them they're a good person. I don't know. I mean, I can't remember the specifics of the study. There are many follow up studies since. But what they found is that when you get some social support, then it reduced the cortisol reactivity of social rejection. It also reduced the dorsal anterior singulate reactivity. So they still experienced the same rejection. They still believed that they were playing this game against two other people who were ignoring them intentionally. But it increase their stress hormones quite as much and didn't cause the dorsal anterior cingulate to freak out as much, presumably because it wasn't as painful. Which sort of illustrates an important point about social rejection and belonging. We don't need to be connected to everyone or feel connected to everyone. As long as you feel like there's at least one person or a few people who have your back, who you can trust, who you rely on, who are there for you, then other people rejecting you doesn't bother you as much. And if it's those times where we don't really feel accepted or supported by anyone. Where we're constantly seeking support and acceptance from everyone. Because we feel all of those social rejections more painfully. And so you either you might notice this about yourself or friends that you have where they're constantly, you know, trying to be accepted by everyone. And it probably means at some level they don't. They have those deeper relationships they can really trust and rely on. And so they feel that social rejection more painfully, And this is related, though not entirely, but somewhat related to how you were raised. It's also related to your genetics, which is not necessarily anything your parents can influence. But some of what we know about our response to other people and how the Olympic system develops comes from studies of other mammalian species. In this study, some scientists notice that rat mothers have different behaviors when it comes to caring for their babies. Rat mothers lick babies a lot. And don't think I just noticed in the notes it says some rat mothers like their babies at. We can't really know whether the rat mother likes their babies or not. That's just a typo. And this is what psychology studies, well psychology studies behavior. We can kind of infer or guess that mental states from that behavior, but we don't know whether they like their babies or not. That's sort of projecting some human emotions onto that. But we can see, ah, well this rat mother licks her babies a lot. And this one doesn't lick her babies a lot. And when we see what happens over time, well the of high licking mothers and babies who get licked a lot. This, by the way, is one of the primary ways that rat mothers interact with their babies. They feed them. Or if they're not feeding them, they can sort of groom them and lick them. You know, they're not playing with balls or playing catch or watching, you know, the ipad with them. Like this is how they interact with them. So some mothers with their babies and play with them more and more physically responsive. And others like, oh, I'm just here to feed you. They found that the babies who got licked more when they grow up, they tended to be more exploratory and less anxious and more resilient to hardship. For example, they showed less of a fear response. They weren't as reactive to stressful situations. They had lower levels of stress hormones like cortisol. In general, we would tend to describe them as less anxious simply from being licked a lot. When the female of high looking mothers, the females who got licked a lot when they had babies of their own, they became high looking mothers. In contrast, the babies of low licking mothers grew up to be more anxious in new environments. They wouldn't explore as much. And they generally were more stressed out and had higher levels of stress hormones. When they grew up to be mothers, they became low licking mothers and they themselves did not lick their babies very much. There are also some results from the hippocampus. They found that from this other study that the expression of certain genes in the hippocampus and other regions that regulate stress reactivity. Can be transmitted from one generation to the next through behavior. This is going back to the idea we talked about last time of epigenetic mechanisms. Well, you can have a certain gene, but then depending on the parental experience you have, you get licked a lot or don't get licked a lot. That can change the expression of those genes, would then change how reactive your limbic system is to stress. One of the questions that can arise from this nature, is it the genetics? Because these mother, well, they yeah, licked a lot, probably because they had genes maybe that made them lick a lot. And then they passed those genes onto their children and that made them lick a lot. And other mothers didn't have those genes or they had different genes or was this a behavior? Does anyone have a guess from looking at or from your own experience or other stuff that you know, like what would you think? Yeah, that's exactly what I would say. It's like, I feel like whenever I was in Cole, they were like, oh, is this nature or nurture? And then they'd be like, oh, is this it's pretty much every complex trait, whether it's humans or in rats. Like it's almost never one or the other. How can you be sure? Well, if they're not certain, it means that there's some evidence on one side and some evidence on the other side. And the problem comes when you're trying to think about it in a binary thing, it's like, well, it's either this or that. It's like, well, if it's very clear that there's evidence as only genetic as is the case with, you know, some conditions, you know, like hair color. It doesn't matter your behavior, I guess behavior does influence your hair color If you dye your hair when there's evidence on both sides. Like it means likely, yeah, there's probably some of both. But what these scientists wanted to see is like how the contributed and their initial thought was like, well, is one more of a contributing factor than the other. They took mice who also exhibit these similar behaviors. Mice are good for studying because it was easy at the time to get them to be genetically identical. They took one strain of mice that are all genetically identical. This was the AJ strain, you don't need to remember what they called, but you can think of them as the anxious mice. These mice, we're generally more anxious if you put them in a new environment. They wouldn't like explore a lot. They were trying to run back into their hole immediately. That's how we can sort of describe them as being anxious versus this other strain of mice would be described as exploratory. You give them access to a new environment. They're like, oh, what's this? And they're, you know, climbing around and investigating. Then they took babies from each parent and swapped them at birth. So they'd be raised by a different mother. That way they would be able to separate like, oh, is this does it matter the genetics of the baby, or does it matter the behavior of the mother when they're being raised? They did this, by the way, because one of the problems that you could find with the study, does anyone see a problem with a study, as I described of like, well, you swap some babies and see what they have and babies are raised by the same mother. Yeah. You don't have a control group, is what she said. Right? So you wouldn't know if that was your study, like oh well some of these, bam is going to swap to a different mother. You don't know, is this the stress of being swapped to a different mother that's causing whatever results I see. Or is it the specific genetics or specific behavior? How could they control for this? Well, this is really important to understand. In any study. Particularly, real life studies are often confounding variables. Variables that get in the way of our ability to interpret what the data means to get around this. They were like, ah, well we won't leave any babies with their same mother. We'll switch all the babies. It's just that some babies will switch to a mother with a different genetic profile, and some babies will switch to a mother with the same genetic profile. So they're all getting a different mother. It's just that that mother either has the same genetic profile as them or a different one. And so that's what the same mother condition is. And then as the babies grew up, they stuck them in this environment where they could either, there was sort of two sides where they could either stick on the side that they were familiar with or like walk through their little mousehole into this other side that was like new and fun and filled with, you know, stuff to climb on. Then they just measured how much time do they spend in the new side, exploring. And that was their sort of shorthand for how exploratory, or by contrast, anxious they were. And they found that, perhaps not surprisingly, that exploratory mice, that is genetically exploratory mice who were raised by exploratory mothers, ended up exploratory. Not necessarily that surprising. The genetically anxious mice who were raised by genetically anxious mothers, even though it wasn't their own anxious mother, were less exploratory. And that's why we define them as anxious. They didn't study specifically licking behavior in this study. But we can infer from other studies like oh, well probably the mothers who licked their babies lot. Those were the exploratory ones and they raised became exploratory. And the ones who didn't lick their babies lot, they were more anxious and stressed and they weren't as exploratory. But what was really interesting was when they looked at the other iterations of the study, because exploratory mice who were raised by anxious mothers were still exploratory. You could interpret that at first glance as like, oh, okay, so I guess it's genetic. They had the genes to be exploratory and they had some mother who wasn't super anxious and like whatever their genes still made them exploratory, Spent a lot of time on this new side, exploring. But what complicates that picture is the, the genetically anxious mice who were raised by an exploratory mother were also exploratory. They had specific genes that weren't necessarily a blueprint to become anxious. As we see, they didn't become anxious, but maybe they conferred a certain vulnerability or a likelihood to become anxious. Except that based on the parenting that they had, maybe their mothers licked them a lot. That caused epigenetic changes such that they didn't become anxious, they instead became exploratory. And this is the case with so many different complex behaviors. But certainly is with this that it's not simply one or the other. It's not simply nature or nurture. Yes, genetics plays a role. Parenting, or early childhood experiences play a role, and they can interact with each other. When we apply this to humans, I mean, it's a bit of a stretch, but essentially you can understand that some people that have certain genetic profile, that regardless of whatever situation or parenting they had or stress or trauma that they went through as a child, well, the genes that they had, they were lucky enough to be resilient to stress. And that's how you can see some people, they went through terrible trauma and they seem perfectly fine. I mean, there are other explanations of that. Stress can actually make us stronger. It's a separate issue. There are other Who maybe have more genetically anxious propensity. Where if they had unsupportive parenting or if they had anxious parents, then well, they're more likely to be anxious. On the other hand, you might have a certain genetic profile that might tend to make you anxious or make that anxiety get in the way. But if you had supportive parenting or were taught how to deal with the brain, that you have a well, then they can rescue you from the consequences of that anxiety. That's a really simplistic way of looking at it. But genetics does play a role, and parenting does play a role and they interact. Another way of saying that is like, for some people, parenting has less of an effect on them because they were going to turn out, however they're going to turn out. And other people are more sensitive to the specific type of parenting that they got. And if they got more anxious parenting, then they're more likely to be anxious. And if they got more calm and supportive parenting up, then they're more likely to be calm and exploratory. Now one of the mistakes that we can easily make is to interpret one of those mothers or parenting styles as being good and one as being bad. Because you could look at these mice or rats and just be like, oh, one of them is just such a good mother. She licks her babies all the time and so supportive and her babies grow up and be really exploratory. And the other one is a bad mother because they don't lick their babies, and their babies become anxious and stressed. But that's probably because you have this belief or value that it's good to be exploratory. That's why you ended up in college. That's where you're trying new things. And why is it good to be exploratory? Well, it's good to be exploratory in places or environments where there's good stuff to be found. Right. And it's bad in fact, to be exploratory where there's a lot of danger. Because if you are, say, grew up in an area with high crime rate, where you grew up in a war zone, something that was extremely dangerous to go outside will actually be bad for you to be too exploratory. I think it's actually easier to understand in terms of mice is good for mice to be exploratory. Well, it depends. Are there a lot of cats around, like one mother? Oh, they're teaching the baby to be exploratory. But if they're an environment with lots of cats, that's actually bad because the baby's gonna go out and like, oh, I wonder what's ah, like you get eaten by a cat. And the mother who's teaching their child that, no, this is a dangerous environment. Don't explore too much. That child, we better equipped to deal with that challenging environment. It's just, oh, it comes at certain costs of like, oh, you have more anxiety or stress, but it's not inherently bad in and of itself. It's just that may or may not be best adapted to the environment that you're in. And in our situation here, you see like for the most part, it's a safe environment where there's lots to be gained by exploring. And that's why, oh, we have this, you know, feeling that probably anxiety is bad because it keeps you from exploring and getting all this wonderful stuff and, you know, meeting new people and making more money or whatever. But it's not inherently bad. It's just helpful to recognize, oh, well, what's my own tendency and how did my parents treat me and how they treated me may not be the most helpful for this situation that I'm in, but that's not initially their fault. Like they were just parenting the way that they were parented and the way they were parent was probably adapted to the environment that they came from. Or maybe the environment I was in as a child. Now, maybe your environment is different. And so a huge part of what, why I want to share about this is because it's a complex issue and you are the way you are right now. And that's perfectly fine. If you find that oh, some aspects of how that is get in your way, okay, well, you can learn to adjust, but don't judge yourself or criticize yourself for being that way, because there's not something inherently better or worse about being someone who is exploratory versus anxious. The mechanisms that these largely go through are through a molecule called oxytocin, which is sometimes called the love hormones. Hormones, by the way, are chemicals that are released into our bloodstream that have many effects. Oxytocin also is sometimes released from one neuron to another neuron at a synapse, in which case it acts as a neurotransmitter. It's sometimes called a neuro hormone because it's sometimes a neurotransmitter, sometimes a hormone, depending on where it's released. It has these effects of increasing our attachment and sense of trust with other people. But it's not an entirely positive chemical in that it can increase aggression. It doesn't just make you calmer, it increases aggression to protect people who you are connected with. So like this is why, you know, they have the idea of a mama grizzly, like you don't want to come between a mama Grizzly and her cub. Why? Because she's got a ton of oxytocin and it's wired to protect that cub. And if you come close, you will see you as a threat. And it makes her more aggressive because of that oxytocin and that bond with her cub. So it's not just, oh, people with more oxytocin are cam like no, you can potentially be much more aggressive when the people you're connected to or that are threatened. And this is produced by the hypothalmas and the hypothalin has a lot of receptors for it, which kind of highlights its central role in our survival. Because the hypothalamus primary role is one of the main things we've been talking about all quarter, which is this idea of homeostasis is yeah, you need a certain amount of oxygen, you need a certain amount of food and blood sugar, and temperature. And if those go out of balance, that creates strong emotions because you could die. And oxytocin, ah, also one of those chemicals that you need in order to survive and to regulate your emotions. It has a number of powerful effects, including reducing stress and making us feel calm, reducing pain, as well as reducing drug cravings and some of the negative effects of drugs. This is the chemical structure of oxytocin right here. You want to make careful note of that. There's a hydroxy group over here for the exam. I'm just kidding. You're not going to have to know that, but I'll just show you that that's what it looks like. Oxytocin. I could quiz you on it, by the way, since you guys didn't laugh at you guys don't think that was funny. Oxytocin gets release in a variety of ways. One of the primary ways is a baby that gets released is through breastfeeding. Mother releases oxytocin when she is breast feeding, and that bonds her to the child. The also releases oxytocin when it is breast feeding that bonds it to whoever it's breastfeeding from one way that it gets released. Oxytocin also plays a much bigger role in childbirth. It's actually an increase in oxytocin that causes urine contractions, which lead to labor because nature figure this out, a great, we'll use this chemical and it'll reduce labor. And then the baby comes out. The mother will have all of this oxytocin floating around and she'll be more likely to be bonded to the baby. And then she'll start breastfeeding. And that it causes a effects also caused by hugs or light tender touch later on in life that can be released by sex. I think crucially, both of these things about touch and sex have to necessarily be related to consent. I don't just say that as a political issue, it's because someone doesn't just automatically release oxytocin, someone touching you in a tender way that you want to be touched. Releases oxytocin, but like, you know, if your, you know, mother or father gently, you know, caressed your head while you were upset or, you know, your boyfriend or girlfriend like rubbed your cheek or the back of your, you know, ear to be tender and playful, like oh, that would release oxytocin and make you feel good and more connected to them. If some random stranger on the bus did that to you, you would not be more connected to them. So it's really about the fact that this tender touch is one way that we show that we trust someone. That we are vulnerable. We're allowing them to touch us in this way. And anytime we are vulnerable and show that we trust someone, we release oxytocin that makes us trust them more. And if someone shows that they trust you, you release oxytocin and make yourself feel more connected to them. And this can be potentially very dangerous because one of the worst things that you can do is to trust someone who isn't trustworthy. And this is one of the fundamental challenges of being human, is that you can't really know who to trust. Like we need each other to survive and be happy. But it's hard to know like, is this person worthy of my trust or not? Should I be vulnerable with them and trust them more or should I protect them because they're trying to, they're trying to manipulate me and gain my trust so that they can take advantage of me. Talking with people, particularly about deeper topics that are more important to you. That also helps release oxytocin. And oxytocin is very much related to this carrot reward system that I was talking about that gets us to want to connect with people, oxytocin neurons from the hypothalamus where it's produced project to this new brain region we haven't talked about yet called the ventral tegmental area. This is part of the brain stem in the mid brain. It's down here. And that's the brain stem region where dopamine is produced. We've talked a lot about dopamine in the nuclecumbents, gets released, the nuclecumbins, How does that dopamine get there? All the dopamine that is released in the nucleucumbents is produced in this brainstem region. And those neurons release it in the nuclear sucumbents for rewarding behavior. One of the cited things that they found was that rodent mothers, not adult, not humans. Rodent mothers who lick their babies a lot have higher levels of oxytocin in the hypothalamus. And that sort of leads to this idea of like, oh, right, no wonder they lick their babies more. Because the hypothalmus is projecting to this dopamine region producing region of the brain. And they find it more rewarding and enjoyable. They get this dopamine boost when they lick their babies, and that is why they do it more. It also has these other benefits for the baby. But they are doing it because of the modulation of dopamine. We know that it's a connection between oxytocin and dopamine from this other study which we, okay, let's forget about the hypothalamus, squirting dopamine into the VTA. Let's just inject some oxytocin directly into the VTA and see what happens. We know that's what we're controlling. They found that oxytocin infused directly into the VTA, this ventral tegmental area, increased dopamine release in the nucleicumbans. Oxytocin comes from the hypothalamus to the VTA that stimulates the VTA to produce more dopamine and release it in the nucleus acumbens. And that's what creates this rewarding aspect of oxytocin. It makes us enjoy the people who we are already connected to. And you want to be close and tender with them because it releases dopamine and it reinforces that. Oxytocin also has these stress and anxiety releasing effects. For example, oxytocin reduces the reactivity of the Amigdolaa. I think I talked previously about how if you show someone pictures of emotional facial expressions. Then the Emigdola has this automatic reactivity, and if you label that emotion, we talked about this a few weeks ago, oh, then you reduce that emotional reactivity. But this found also if you have a lot of oxytocin, in this case you get a little nasal boost of oxytocin. And you show these various emotional facial expressions. In every instance, the amygdla has a reduced reactivity to that. Whether it's anger, fearful, happy by the way, more negative is lower. So if you look at any individual pair of bars, whether it's placebo or oxytocin, when the person gets this boost of oxytocin, then it reduces how much the magdala activates. And that kind of makes sense because like when someone you don't know who is potentially threatening, you can't necessarily trust when they're really angry or they're really fearful, or they're even really happy. There's a lot more uncertainty, like, are they angry? Are they angry with me? Are they going to hurt me? If you trust someone, you know someone Oh, well there's a lot less uncertainty. There's a lot more sense of control. Why would do your Meg dele, react when someone else is really happy? Well, why are they so happy? Like, is it something that they're happy because they don't like me and something bad is gonna happen to me. Or they just trying to be happy so that I'll be happy so that I can, you know, I'll trust them more and let my guard down 'cause they're trying to take advantage of me. I don't know. There's a lot more uncertainty when a stranger is unhappy versus when someone you know and trust is happy. When someone you know and trusts is happy, oh, well then you're much more likely to be happy. By the way, why does this? They have this readily available boost of oxytocin that says a nasal spray. It's because when woman is pregnant and isn't going into labor soon enough, they can induce labor by giving her a boost of oxytocin. It's a medical name is putocin, but it's just oxytocin because that induces, induces labor and uterine contractions. Oxytocin also helps protect the hippocampus from harmful effects of chronic stress, which can damage the hippocampus. It can cause growth of new neurons in the hippocampus, which is something also that antidepressant medications have been shown to do. And they can protect the brain and particularly the hippocampus, and even reverse some of the toxic effects of chronic stress. The oxytocin system is one of the mechanisms by which our parents affect us positively or negatively. But for a long time, research have known like, well, it does seem that parents have a big effect on their kids. And the relationship that you have with your parents seems to say something about how happy you are or how easy is it to connect with people later on, or what your life is going to look like. And a lot of that research came from something called the strange situation. The first type of attachment, that is the relationship between the, for the child and their parent. In this case, they just use mothers because the research was a lot more sexist. 30 years ago, it's still pretty sexist, but it's easier to just control. And so I'm just going to talk about mothers. But you know, there's been more research done more recently. But in these original studies they described when they put people in this situation called the Strange situation, which was, oh, the mother and the child were allowed to play in a room together, there were some toys. Then a stranger came in. It's part of the strange situation. Then the mother leaves the room, and then the mother comes back. That's the situation. They notice that when a child seemed to have a good relationship with their mother, that they were calmed by their mother's presence, that they had this sort of exploratory nature. Well, they noticed a few things that they described as secure attachment. So what secure attachment looked like was, well, when the mother and the baby were alone in the room, the baby would just kind of explore, kind of like those exploratory mice. Then when the stranger came in, well, there's uncertainty. What did, who was the stranger? And the baby would look to the mother for reassurance. And the mother would generally be, ah, it's okay, keep playing. And the mother would be calm about it. And so the baby would keep playing. Then the mother would leave the room. The baby saw the mother as a source of safety and security. And so the baby would start crying. When the mother came back into the room, the baby would be happy to see her and would be easily comforted. All of that just indicates the baby sees the mother as a consistent source of safety and security. And that is called secure attachment, but that is not always how the situation plays out. Babies displayed what's called anxious resistant attachment, where when they first go into the room, they're not exploring as much. Either they're just, you know, more anxious or they look at the mother like, should I explore more? And the mother might be anxious and is like like, oh, I don't know if that toy might have germs. So like the baby isn't exploring as much for a variety of reasons, but that's what they can see behaviorally. Then when the stranger comes in, the baby, you know, goes to the mother and doesn't want to explore anymore. When the mother leaves, the baby is, you know, inconsolable and super upset. And when the mother comes back, the baby is still super upset and isn't easily calm down. They resist being calmed, which is where the anxious resistant name comes from, because they're so worried that the mother might leave again. Like oh, they were worried that in anxious resistant attachment, the baby doesn't quite see the mother as a fully secure, reliable way of calming down. They want to be calmed by the mother, but they're not able to be fully calmed by the mother. And so they need the mother. And this is the mother, for whatever reason, isn't fully able to calm them, Either just from that's how the baby is, or because the mother herself and her emotional circuitry reacts in a way that makes it harder for her to calm the child. Anxious avoidant is a pattern they saw, well, when they first go in the room, the baby isn't quite as exploratory. But it's not like looking to the mother for support. It's just doing its own thing. When the stranger comes in, the baby, might you look at the stranger, but it's not like looking to the mother for support when the mother leaves. Baby's not that upset when the mother comes back, baby doesn't really care. Anxious avoidant is another example where the baby does not see the mother as a fully secure and predictable source of safety. But they've just taken a different approach, which she's like, oh, I guess I'll just do this on my own, like that lady is not going to help me. So I'll just, you know, who cares if she's here or not. So the fact that a child cries when the parent or their mother leaves, that's a good sign that they are attached to them. Just ideally, they would also be able to be reassured when the mother comes back. And then they noticed there's also some patterns that didn't neatly fall into these categories. They call that disorganized attachment. This is very rare, um, at least with these other forms of attachment. The baby knows or has a consistent way to feel about the mother. Like in secure attachment. Ah, the mother is a source of safety, and I can rely on her in both anxious, resistant, and anxious avoidant. It's either, oh, the mother isn't a consistent source of safety. Well, in both of those, the mother isn't a consistent source of safety. So the baby makes a choice. Either therefore, I need to cling to her as much as possible, or, oh, I'm just going to be on my own. But either way, the mother is consistently seen, like, not totally consistent, as a source of safety in disorganized attachment, the baby doesn't know what to feel. And this can be an extreme example of a parent with like bipolar disorder or alcoholism, where sometimes they are loving and nurturing and safe. But other times they can be, you know, violent or abusive and the baby doesn't know how to feel that, oh, they seem really nurturing and supportive. But then that creates this anxiety like, oh, is that just going to lead to violence? And that's some of the most harmful for development. Now, while you're diagnosing yourself and your friends potentially, I want to reassure you that most people have secure attachment. There's like a wide boulevard that is secure attachment and it can look a lot different like how your secure attachment to your parent might look different from your friends. So before you diagnose them. But these issues, whether you, you know, maybe ten, thinking back to your childhood, tend to be more anxious, resistant, or avoiding or whatever. They're really only problems in the extremes. So it's a wide road and you know, the gutters are far on outside. But. Um, so that's good news, before you criticize your parents too much. As we get older, attachment styles change, the strange situation describes attachment styles from baby to their parents. But as adults we have similarities between that situation. It doesn't have a one to one mirror, but there are some similarities, so secure, and by the way, if you have one type of attachment style as a baby, that doesn't mean that all your relationships will be that way when you're an adult. But if you have a secure attachment style as a child and it's easier to form secure attachments as a result. And if you didn't, that's okay. The treatments, their therapy like, you can just like if you didn't learn a specific language when you were a child, well you can learn it now. Just don't get too critical of yourself because it's still possible U. So in adult relationships, and we can have different relationships with different kinds of people, but a secure one in which you find it relatively easily to become close to others. You're comfortable depending on other people. It's still some stress and anxiety around it because there's always uncertainty, but you don't worry too much. You're not too preoccupied with it. By contrast, if you are preoccupied, wonder is like, oh, do people, do they really like me or are they just tell me they like me, but they don't really like me. Talking about me behind my back like someone you're in a relationship with someone and you don't fully trust that they're not going to leave you, or you don't know if you should trust them. And you're what's described as clingy, you might think of this as yourself or a friend. You're preoccupied with it and it's more anxious. You're uncomfortable with close relationships because you desperately want close relationships, but it creates a lot of fear. That's anxious, preoccupied. The contrast with that is fearful avoidance in which you desperately want close relationships. But it creates so much fear that you're like, wow, you know what? I never mind, I'm fine on my own. So, and that is just a different strategy with dealing with that anxiety. And that is different from this other style, let's call dismissive avoidant, where someone is just totally comfortable being on their own. They could depend on other people, they just don't want to because they don't get much out of it. And a lot of times people who are fearful avoidant, pretend or lie to themselves that they are dismissive. Avoidant, they tell them. So now I don't really need other people because it's a defense mechanism. So they can avoid the fear of having to do it. And that just sort of puts us on these two axes. That of proximity seeking mean how much desire do you have to get close to other people and how much anxiety do you feel? We all have some anxiety because it's important to us and there's some uncertainty. But generally, you want to be close to other people and you don't feel an excessive amount of anxiety about doing it. That is an example of secure attachment if you really want to be close to other people and you tried really, really hard and you're still really anxious about it and you're constantly preoccupied by it. You might have anxious preoccupied because you're clingy. Or if people would describe you as clingy, if you have fearful avoidant, well, you're still really anxious. But your way of dealing with anxiety, about being with other people is like, okay, well I'm just gonna be by myself now. I'm fine. I don't need anyone else. I can do everything on my own, but there's still a lot of anxiety associated with that as opposed to dismissing avoidant where you're like, no, I really am independent. I really don't care one way or the other. And that's characterized 'cause like, yeah, you don't have a lot of anxiety, you don't want to be close just because you don't really care. And I'll finish up with these brain regions and how they correlate with attachment style next time. Just because I want to make sure that you're aware of your intervention for this week. We can talk about it more in section, but this week your goal is to use social media as part of your bedtime routine. This is where some of you might be like wait, but aren't we supposed to avoid social media like this is why it's an experiment. This is the first one where you might not have a preconceived notion that it is definitely going to be good for you. That's one of the confounding factors of all the other studies that we've done so far. You're like, oh yeah, I should exercise. Oh yeah, I should meditate. Oh, I should practice gratitude. So this maybe think, what is the effect that you think this will have when you use social media for 10 minutes as part of your bedtime routine. Do that for three nights and therefore don't use it for three nights or the rest of the time as part of your control routine. By the way, next? Well, you're going to come up with your own intervention, so start percolating on that.

Week 6 Lecture 1 (Lecture 11)

Okay, so where are we going? Okay, so we're going to continue talking today about some of these social aspects of the brain and well being. I suppose I should also give a disclaimer. I don't know if that's the right word, but sometimes when we were talking about science, and science is trying to simplify or steady, or quantify the complexity of human experience. There might be some rough things around the edges that you say, oh, well that's, you know, you can't really simplify it in that way. If there are any things that I say that are, you know, you find distasteful or offensive, I certainly apologize. It's not my intention. I would like to acknowledge that science is just a tool and that's my job to teach you how to use this tool. Sometimes that tool can be used in discriminatory ways. It's certainly been used like that in the past. But just like any tool, like a hammer can be used for useful things, it can be used for destructive purposes. This is just one of the things, if you ever have a disagreement or a concern about the way I'm talking about any of these issues, like please talk to me after class or in office hours. I think that also really reinforces one of the main messages of this class, both on the scientific side and on the well being side. Because from the beginning of this class I've talked about a lot of people what they think, what science is is memorizing a bunch of stuff. That there's a bunch of people in an ivory tower telling you what is correct or incorrect. But in fact that is not science is science is a bunch of people trying to figure something out and a bunch of other people trying to figure out the same thing. And they're like, mm, this doesn't make any sense. Like what you guys is doing doesn't make any sense, or what that lab is doing conflicts with our results. Yep. Just like the human experience that you can have different data or experience from other people. And as far as science, that is perfectly okay. The way that science is often portrayed in the media or the way that we're taught it a lot of times is that there's one thing that's true and you have to believe it or you're wrong. But scientists argue with each other all of the time. They just recognize that's of the part of the process. That even when you do this study and you spend millions of dollars studying something, you submit it to a journal. Won't they have reviewers who read this and like, mm, that sounds like bullshit. They don't say that. They say, oh, could you please explain your methods a little bit more? And you could publish an article and someone else could publish an article completely disagreeing with your article. One of things that I've noticed that great scientists do is they try not to take things personally, which is hard to do when you've worked really hard to focus on something. But disagreement is inherent to the scientific process. And I welcome to hear different perspectives. Or if you have commentary on how I'm delivering this information, I certainly be excited to hear it. Yeah. Anyway, and that would also, that discussion is part of the scientific process which is help both with your scientific education and if you're like, I'm annoyed this guy keeps talking about this thing and this, great, that would probably be helpful for your well being to share that. We'll talk next week about difficult conversations and why it sometimes feels stressful to talk about things that are important to you and we get stuck. Should I talk about this or should I just suck it up? We'll have a lot of strategies about that next week. But to revisit what we were talking about last time, we were discussing this idea of attachment. And the way that this has been studied a lot in the past is with this experiment called The Strange Situation where they took mothers and babies. Thinking about this is sort of why I wanted to give that disclaimer because, yeah, historically, that's how this has primarily been studied. And so that's where most of the research is at with mothers and infants. That is to say that fathers can't be good parents. No, you might think, oh, well there's not research on it, but science is just a tool. It may not always be used in the way that you would like. This is just one point that I wanted to make. The attachments that we form with our parents, the style of attachment that we have with our parents, how our brain develops or it reflects tendencies of our development over time. Research shows that if you develop a secure attachment, either with your parent or your caregiver or someone, it's crucial. But if you can develop that secure attachment with someone, it leads to so many positive outcomes in so many different areas of your life. It's much easier to be happy and emotionally well regulated as an adult and more exploratory. And easier to make friends and make more money and be more successful and avoid jail and all this amazing stuff, you don't have secure attachment as a child, then it's harder to accomplish a lot of those things. It doesn't mean, again, that this is going to dictate how your life turns out. It's just helpful to understand that this relationship you have with your parents has an extremely profound effect. Your genetics has extremely profound effect on how your brain reacts in your current situation. Your early childhood experiences, both traumatic experiences, and your relationship with your parents also has an extremely pround effect through epigenetic mechanisms. Those genetics and epigenetic mechanisms can interact, which gives rise to a lot of why your brain is the way it is right now, combined with your current circumstances, the habits that you've practiced, your relationships and so on. Anytime you're sort of stuck on something, or worried, or anxious about something like whoa, these three different things give you an idea of why you might be feeling that way or what you could do about it. It's just that, well, you can't go back in time and change your genetics. Go back in time and change your early childhood experiences. But you can reframe them or you can learn to accept them or focus on the positive. And those are things in your current circumstances that you can do. So when we talk about these things in the past, the purpose is to help you better understand and manage your present circumstances. This strange situation, just to reiterate, because it's kind of complicated when children display secure attachment. What's supposed to happen to follow this pattern is that the child explores. And then when the stranger comes in the room, the child should look for security and safety from the parent or caregiver because that's who they are attached to. When the parent or caregiver leaves, the child should be upset because that's an indication that they are attached to this parent and not the random stranger who's there. And when the parent comes back, the child should be able to be comforted and calmed down. The fact that a child is upset when the parent leaves, that is generally a good sign that they have secure attachment. Although there are other, you know, that's not the only sign. It's a complex thing, It's not just one thing. An anxious resistant attachment, the child isn't as exploratory in the first place. Why? Because they're anxious about trying to explore new things. They're much more anxious when the stranger comes in the room. They're trying to seek reassurance from their, but their isn't successful at reassuring them. Maybe it's, it could be a variety of reasons. One potential example is if the parent themselves has a lot of anxiety, well then the kid is feeling anxious and they look to the parent for reassurance. And the parent can't successfully reassure them because the parent is super stressed out and the kid is affected by that stress. And so they're seeking that reassurance, but it doesn't fully come. And so they're super upset when the parent leaves, kind of because they were already stressed out to begin with. When the parent comes back, they are almost inconsolable because now they've even triggered their further anxiety that, well, the parent isn't fully dealing with my anxiety and I might not even have that parent because they might leave again. So it's called anxious resistant because they resist being calmed. Anxious avoidance is where they've sort of learned, oh, this parent isn't successful at helping me regulate my stress. Instead of continually trying to get the parent to be better at regulating my stress and failing, the child has decided, oh, well, I'm just going to forget about them and do my own thing, and I'll just play by myself. And when a stranger comes in, I'm not really going to care that much. And when the parent leaves, I'm not really going to care that much when the parent comes back. I'm not really going to care that much. All three of those represent consistent relationships with the parent. Either the child consistently views the parent as a secure, consistent form of safety that they can rely on, or in the anxious attachment styles, insecure attachment styles, they don't view the parent as a consistent form of safety, but they consistently see, oh, in order to deal with that inconsistency, they either keep trying to be reassured by the parent or they give up and like, great, I'm not going to try to connect with this parent. The problem with disorganized attachment is when the child doesn't know what to feel either in extreme cases like drug abuse, or alcohol abuse, or untreated bipolar disorder, or something like where the child doesn't know what to feel. Those are the most extreme problematic cases, but most people have secure attachment. It just might look different from different people. There's a wide road, even if you can self diagnose yourself, have insecure attachment like that's not necessarily a problem as long as you recognize about yourself and recognize how it might impact your current situation. Because when you experience secure attachment as a child, it's just easier, more common to experience secure attachment in adult relationships. This is romantic relationships and friendships where yes, you want to be close to people because we get a lot of benefits from that. And it's just that you don't experience an unnecessary, unreasonable amount of anxiety about that. Yes. It's always a little bit nerve racking when you ask someone out on a date or like when you're dating someone and you're not sure like is it going well or are you going to be friend zoned. Like this. Normal part of forming relationships with people is that there's some anxiety because you don't know exactly what they are thinking or feeling. You are vulnerable, which is a requirement to sort of form deeper attachments. But because you are vulnerable, because you trust this person, it means, oh, they could hurt you or make you feel bad. So there's going to be some amount of stress and anxiety around that. But as long as it doesn't prevent you these relationships that are important, then you can still have secure attachment. When, however, you get preoccupied with the stress of close relationships, like you desperately want close relationships. But when, when you're in a close relationship, you consistently need reassurance that indeed this person does care about you or they can be trusted. It can be described as clingy because you're like your friends tell you, oh no, no, no, we don't have a problem. You're like, you're sure you didn't text me back right away or your partner or something. Like that can be described as anxious, preoccupied attachment. That is caused by having this greater anxiety than is necessary about forming close relationships. You desperately want to, but it creates a lot of anxiety and yet you still keep trying in fearful avoidance, you have a lot of anxiety about forming those close relationships. And the response similar to the avoidant baby where you're like, oh, you know what? The easiest thing is, not needing anyone, let me just not worry about relying on other people. I'm just going to be independent and you're not actually conscious that you're making this choice, but it can be really appealing. Because we can tell ourselves like, oh no, I'm not afraid of being in a close relationship or relying on other people. I'm just independent. I just don't need other people. And it's really easy to convince yourself of that because you're brain is really good at self deception. You might not even realize your own motivations because, you know, when you think about, oh, maybe I should rely on someone like before the thought is even fully formed. Like it creates a feeling. And the feeling triggers a habit. And the habit, you know, pops the thought into your head like, oh, that's dumb, I'm going to do this on my own, aren't necessarily even aware of the anxieties or feelings that you may have. It is true that there are some people that need, other people experience a lot of joy from connecting with other people. They, you know, could form closer relationships, but like it is a lot of work and they don't really get a lot of out of it. So they don't have a lot of anxiety about forming relationships, but they just, they don't really feel the need to. The issue is just recognizing, oh, is that actually you like, you just don't need close relationships, or you actually desperately want close relationships. Your brain is just telling you like, oh, hey, you don't really need anybody. And that's a challenging thing to figure out. This is one of the reasons therapy exists, But also one of the strategies I would encourage you to take. Sort of one of the main messages of this class is one of self reflection. To just notice your own experiences. You have data, you have years and years of data like huh, that's interesting. After all of high school and all of college, I keep telling myself that I don't need anyone. And that's not because I have anxiety, but like, huh, I don't have any close relationships and I'm not happy about that. Maybe, I don't know, I can't tell you what kind of attachment style is. You could try and take a test or something. But one of the most powerful tools you can use is this self reflection of like, huh, that's interesting. May be the answer is that I have more anxiety about this than I think. And these anxieties that we have and these various attachment styles that we form. There are some echoes between adult parenting styles and child parenting styles. But it's not like, oh, if you have this as a kid, you're going to have that as an adult. Uh, but the one thing we know that's most clear is like, well, if you have secure attachment as a child, it's easiest to then lead to more secure attachment as an adult. And we don't actually have the same attachment styles with everyone. Unfortunately, like going back to this last slide, sometimes we fall into what's called co dependent relationships where ideally, yeah, we have two secure people being in a secure relationship with each other. But the way that one person is triggers the way the other person is. So if you are a preoccupied, anxious, preoccupied person, you're in a relationship with someone who's sort of dismissive. Avoidant or fearful avoidant? Let's say fearful avoidant, you are both desperately seeking, you want to be close with people. It's just you both have a fear of abandonment and the way that you deal with that fear is the opposite. So that one person is like, hey, you know, we're still good, right? Like, you know, let's hang out again Friday. Oh, can we hang out again on Saturday? And other person who is more fearful avoidant will experience that clinginess as stressful. She was like, oh my God. I don't want this person to rely on me. I don't want to hurt them. I get to get hurt. So we're like, oh, no. So that will cause them to pull away and try to be more independent and assert their independence as a way to deal with their anxiety. Which you might see this coming that makes the other person more clingy and more uncertain, and that makes the other person pull away more. And these are the pan, unhealthy patterns that we can get into in relationships. And the reason why I call them unhealthy patterns is simply because it goes against what both people in the relationship desperately want, which is to be, you know, loved and accepted and feel safe. It's just that the ways they are each going about it are making it harder for the other person. And one of the best things you can do is a notice your own relationship patterns. But really more broadly, notice your own emotional reaction about things. And just notice, oh, when is that getting in the way of what you say is really important to you? Is it the thoughts that you're having? The emotions, the actions. And that will just, over time, help you better be able to give yourself what it is that you want, what will make you happy. This is related to what is happening in the brain of the activity of the anterior cingulate cortex as it responds to social rejection in the cyberball experiment correlates with these different attachment styles. It correlates positively with anxious preoccupied attachment. Correlate negatively with avoidant attachment styles. That makes sense. In the cyberball experiment terse people stop throwing the ball to you. That activates in singulate, oh my God, they, that's a mistake. They shouldn't be ignoring me. That feels painful. People with anxious attachment styles experience that rejection as painful. That is what triggers their habits and so on. Because people anxious attachment fear rejection. Whereas people with avoidant attachment styles who really don't need anybody, they don't mind being alone. Well then when the other people with the ball throwing people finally leave them alone, like great, I didn't want those people anyway. So this is seen in the anterior singulate and it also correlates positively to anxious attachment in the insula which processes our internal feelings. That's why you feel it in your gut or you feel more, you know, nervous or butterflies in your stomach about the possibility of rejection. And again, whether you have secure attachment or anxious attachment, like we all feel some amount of that. Like it's good to feel a little butterflies in your stomach in a first date. It's just, ah, is it excessive to the point where it gets in the way of what you're trying to accomplish? This other notion about oxytocin I wanted to dispel is that sometimes people think, oh, it's just entirely positive. It's just the love hormone, that's what we call it. I mean it's often called, in popular culture I showed last lecture, that doesn't just make you overall more positive like in mother bears, it can make them more aggressive. Oxytocin can make you more aggressive to people who you are not attached to. That's one of the potential drawbacks, but it's not always a simple relationship with how you feel. In this particular study, they asked men about their relationship with their mother, the positive or negative memories about their mother. And then they gave them a boost of oxytocin. In men who had positive experiences and secure attachment with their mother, that boost of oxytocin helped increase those positive feelings and reduce their anxiety about relationships. Whereas in who had a negative experience or a negative memories of their mother, increased their anxieties about relationships and their attachment and anxieties. And that's why, like, oh, you know, if you had a secure attachment with your parents, let's say, and then you start to get close in a relationship now as an adult, well, oxytocin is involved in both of those things. And so if you liked the feelings associated with your parents and now you're in this new relationship and boom, you're getting all this oxytocin, well, you're going to like that feeling. It's going to make you feel more safe and connected. Whereas if you didn't like that, the relationship you had with your parents create a lot of anxiety. Ah, well, now when you're in this new relationship, it's starting to get real close and things are starting to get real and you're getting more and more oxytocin. Ah, well, that might feel uncomfortable, might increase your anxiety. And that's why sometimes people are like, oh, you might be fine as long as the relationship is casual. And then once feelings start to get involved, are we talk talking about are we exclusive or whatever? Oh, all of a sudden it starts creating these anxieties because you have more oxytocin and it's triggering these old anxieties. That's just that point that the effect of the opposite. This slide is designed to help some of you trigger oxytocin and caregiving tendencies. That's one of the reasons we evolved this system is because like if babies we're sad and just like, you know, 50,000 years ago and they're sitting on the ground in the tribe or whatever. And people were as a baby and just walked right past it. Well then our species wouldn't survive very well. So the seeing babies, being sad or unhappy or stressed out or in need, we evolved for that to trigger experiences in us. It's just that some people, it triggers stronger emotions and other people get triggered stronger emotions. That's why some people can be described as more nurturing because their emotional circuitry or oxytocin system is more reactive to seeing babies in pain. Now what's interesting about this slide is that you probably have a similar reaction to all of these babies because one of them is baby. And so I don't really care that much about most of these kids being sad. I know that doesn't reflect well on me. Like yes, I don't want babies to be sad, but like, yeah, it's like, can't somebody else deal with these other babies? But like my baby. Oh, because I'm bonded to that one. Like oh, yeah, I feel much more connected because I have oxytocin specifically for that baby. And this one I can recognize her. She's used to have this little red dot over her. Made it easier to pick her out of a crowd. Um, my wife, however, hates this picture because to me I'm like, oh, that's so cute. She's like, oh, she's crying. I'm gonna pick her up to her, it's like, oh my God, like it's overwhelming that this baby is upset, her baby is upset. And here I am like taking a picture and she's needing to pick it up and it's like, right, we have different degrees of responsiveness. That isn't necessarily a problem because it means if you think about the Yorkies Dodson curve, depending On where she is. If she experiences more anxiety about this baby being sad, then well, that actually might get in the way of being effective of what she's trying to accomplish. So I might have the tendency to be not enough stress, where she might have the tendency to be bad stressed or more anxious. But this is one of the benefits of having two parents as a couple where you can kind of have each other out. These are just some more pictures of her growing up. I find them adorable, but that's because my oxytocin system modulates my dopamine system and I enjoy looking at pictures of them. Some of you might, depending on how reactive your nervous system is, some of you might be like, why is he showing this \*\*\*\*\*\*\* pictures of his kids? Which is why, like the classic trope of parents is, they're like, oh my god, look at these pictures of my kids are so amazing and wonderful and like, yeah, they love looking at pictures of kids because they release a lot of oxytocin which modulates their dopamine system. So they love looking at pictures of their kids. And you're like, I've seen pictures of kids before by like, I don't really care. Um, anyway, Sabes, which are designed to trigger our oxytocin system, we evolve through oxytocin system to respond to how babies cry. This study looked at specifically the sound of babies crying and how our brains react. By the way, I should say something about using my wife, an example of she experiences more anxiety about the baby. I think in traditional gender roles, it sort of related to what I was talking about, the being in this class. And traditional gender roles, we think, ah, right, men are this way and women are that way. We think that way because our brains like to make shortcuts because it just makes the complex world simpler and easier to deal with. We'd like to think that blacker white thinking. But that's where discriminatory practices come in, because not all men are the same, or all women are the same, or all people fall into those neat categories, or exactly how you define those categories H, but for the purposes of science and studying things quantitatively, sometimes they have to make oh, certain distinctions, but just don't understand that they are certain assumptions or that they like. We can show, for example, on a graph that one group of people is up here, one group of people is here. But those graphs represent averages of populations that are distributed just because men on average might be one way or women on average might be another way. Well, there's plenty of women who don't have as much anxiety in their husbands or partners are, you know, a nervous wreck about the baby. So sometimes looking at averages of gender differences and science can help us understand ourselves. We're like, oh yeah, I am like that. You can think of my wife and I always joke about like stand up comedians from the '80s and '90s. Like women do this and my wife like, okay, sometimes that's informative and that's sort of why it's funny. Sometimes however, you're like, oh, I see the limitation of that way of thinking and that teaches us something else about ourselves. But in this particular study, took women and played them the sounds of babies crying, and either gave them a boost of oxytocin or a placebo as a control what this is showing, because if you remember FMRI, we always have to compare two conditions. At least they're saying, okay, what are the brain regions that are greater when they have oxytocin and listening to crying more than the control condition of not listening to crying? Which of those brain regions have a different difference than when they have the placebo and are listening to crying versus the control. It actually understanding that they're just subtracting different conditions from each other. Essentially it. Okay? How does your brain, which are the brain regions that have less activity while you're on oxytocin or on a boost of oxytocin? What they found is that That is because that's what this sin is right here. Oxytocin than pbo. What are the brain regions that have less between those conditions? And what they found was the amidola showed up. Why would that be the case? Well, we know that oxytocin from last lecture, oxytocin reduces amid reactivity also because like, well, we've all had that experience of being on an airplane or in some situation where someone's baby is crying, it just won't shut up. And like it's really irritating. It's like it's not enjoyable to just like hear baby's crying if you can't do anything about it. But oxytocin makes you feel more nurturing and capable of caring for this baby. So like if you give this boost of oxytocin and hear the baby crying, you're like, oh well then it makes you feel more connected and nurturing to that baby. Which is why one of the explanations why it may reduce a Gd reactivity as well. But if you look at the reverse contrast, what are the areas that have increased activity Oxytocin? Yes. Question, explain why oxytocin study. I think I'm just like, okay, so just the question is why would they do this study this way in the first place of why give them this boost of oxytocin? Because they are trying to see, does changes in oxytocin change how your brain responds to babies crying. So a different way of doing this study is like, oh, they could have just done a more observational study, like oh, you had this attachment style, you had secure attachment style, and you had anxious attachment style. As a kid, how did your brain respond now that you're an adult or you know, You got spanked as a kid and you didn't get spanked, like, how does your brain respond? And there's actually a study we'll talk about in a moment, but they were just more specifically wanted to do this experimental study. Like okay, well if you give you a boost of oxytocin right now, how does that affect your brain? So just a different looking at it. One is more experimental, one would just be a developmental lens and observational, there's different ways of looking at the information that give you different things. A boost of oxytocin reduced the reactivity of these women's brains in the amigo. When they heard crying, it increased activity in the insula. It wasn't like they weren't reacting to the babies at all. No, they felt it deeply. The insula is like, oh, your stomach turn. Oh, I don't want to feel this baby. They just those feelings didn't trigger anxieties. A lot of times what we perceive in the insula, you know, the sensations that we get from our bodies automatically trigger the mid, like we're like, oh, I'm nervous. Why am I nervous? And then like, we're not even aware of those sensations in our body anymore. We just that triggers anxieties and that triggers the dorsal stratum and so on. This is one of the reasons why mindfulness increases our awareness of our bodies or increases insula reactivity. Just because you have sensations in your body doesn't mean automatically have to trigger anxiety. Oxytocin made you feel the baby crying more. It's just those feelings weren't accompanied with increased anxiety. So made it easier to be present perhaps, and take care of a baby. This other study looked at women who had received harsh discipline as kids from their parents say that they were spanked, versus women who hadn't received that kind of harsh discipline when they were kids. Then they gave them either a boost of oxytocin or placebo to see how their grip strength would change. Because one of the goals of oxytocin, when it gets activated and you hear baby crying, well, it should trigger these sort of nurturing tendencies. You're like, oh, you have to be urgent but gentle. It's not like picking up a football. We just, I got to get it as fast as possible, but like no, it has to trigger this sort of gentle touch. So they asked these women to squeeze this grip bar at sort of a consistent level, trying to maintain that same grip strength. And then they play them the sounds of babies crying. Either when they had oxytocin or didn't I really dislike how they label this axis. But it says participants not using too much physical force, which means like if you're trying to maintain exact same grip, well, you either accidentally use too much force or you accidentally use too little force. When women who had received gentle discipline, they hadn't received harsh discipline as kids, when they got this boost of oxytocin, they were way more likely to accidentally use too little force. That was, you know, 90, 75% of the, it's just the automatic relaxation of those muscles in response to crying. Uh, why? They increase their grip when they hear a baby crying? Well, that could be, yeah. When you don't have oxytocin, when your like, if it was your baby crying, that would release more oxocinan. You someone else's random baby crying while you're trying to read or sleep or whatever. That's grading and increases tension. The women who had received harsh discipline as kids, their brains just weren't as reactive to the oxytocin. Sometimes that was good because they didn't lead too much strength, but it didn't really relax their grip either when they had oxytocin. This just sort of illustrates that depending on your early childhood experiences, it can make your brain more or less reactive to oxytocin. And that in some instances might create a problem, in other instances it might help you. But it's still useful to be aware of yourself and your own tendencies. Genetics certainly plays a role in this. For example, people depression. Or more likely to have a specific version of a gene that regulates oxytocin. And these can correlate with attachment styles, genes that control the oxytocin receptor. The oxytocin receptor is a protein that senses how much oxytocin you have. You might have a lot of oxytocin floating around, but if you don't have a lot of receptors for it, they have nowhere to attach to, you can have a lot of receptors. So you're really sensitive to any little changes in oxytocin and genes that control that oxytocin receptor contribute to anxiety and depression. But in a way that it is interaction with your N or your environment growing up. For example, when we look at depressive symptoms, it's hard to see because the numbers are smaller. G and G just represent, if you think back to DNA, this is the iguana dense or whatever. These are just different versions of the gene. Most people, regardless of what their genetic profile is, okay. They have pretty low levels, on average, under 2% of depression. Unless what's this one group up with a specific gene. They had a high adversity childhood, either with trauma or growing up in a difficult environment, or a number of factors that they classified as high adversity. It's not like, oh, these genes are creating the depression. It's like oh, well certain genes create a sensitivity, the environment that you're in. And if you're in a low adversity environment, boom, you're fine. But because of epigenetic mechanisms, well, if you have this gene and you have a high adversity environment, your parents were alcoholics or you experienced trauma or whatever, like you had a high adversity. Environment. Ah, well, that triggers the increased likelihood of depression. Same with physical symptoms, like some people have more likelihood to have headaches or chronic pain or digestive issues. Well, it was consistent across regardless of what genes you had, unless you had this one particular gene and you had experienced a lot of adversity as a childhood, just having adversity as a child. So it's like this one is high adversity, you have high adversity. But based on your genetic profile, you're not that sensitive to it. So it doesn't really create physical problems. It's having the combinations, the interaction of those two also relate connected to social anxiety or other forms of anxiety. I should say in this specific study, they operationalized early adverse environment. That was a different study. The oxytocin receptor gene that we're talking about here, interacts with your familial risk of mental health challenges in order to predict depression and anxiety. In that case, the, um, if you had a mother with a history of recurrent depression, well, depending on your specific genes that you got, some of those genes might mean, oh, you weren't really that affected by it. It didn't matter if you had a mother with depression or not. Depression like your genetic profile made you more resilient. And other people, if you had certain genes and your mother wasn't depressed, oh, then you were probably just fine like everyone else. But if your mother was depressed, environment combined with the genetic profile, increase risk of depression and anxiety. Oxytocin is crucially important in our mental health, such that people with disregulated oxytocin tend to believe that life isn't as worth living. They're more likely to have suicidal thoughts. People who experience child abuse tend to have lower levels of oxytocin. It disrupts the development of it. But it also explains, right, like you've disrupted oxytocin and oxytocin, reduced oxytocin makes it harder to think that life is worth living. That's one of the reasons why there can be greater mental health challenges. Just regulations in the oxytocin system can also increase drug use and addiction. One interesting thing is that we talked about your relationship with your parents when you were a baby. That's sort of the attachment. But something interesting happens in the brain during adolescence, where it starts to become really plastic again and really mallable. This is one of the reasons why the experiences that you have, middle school or high school, can be really impactful, because they're going to affect your brain development a lot. This study looked specifically at stress during adolescence, except that they were looking in rats. They took rats, and they either put them with other rats, or they isolated them. Then later on they tested how likely they were to get addicted to cocaine. This is very much related to what you talked a few weeks ago about reinforcement learning and conditioning. What they did is they took these rats and gave them a little lever to press. That if they pressed it enough times on a variable reinforcement schedule that it would give them an injection of cocaine. Then they turned off the cocaine and just measured, well, how long is this rat going to keep pressing the lever until it says, screw this and walks away? That's called the break points. That measures, in a sense, how addicted they are to the cocaine. Because if they press levers, you know, 20 times and then give up, then they obviously weren't that addicted to the cocaine. When they looked at the rats who were raised through adolescence, in a social environment. Well, those rats gave up, you know, they'd all gotten the same amounts of cocaine up to that point. But those rats gave up after, say, lever presses. Yeah. They kept trying it. They give them a lot of cocaine. They wanted more, but they're like after 70, it's not worth it. The rats who were raised in isolation, however, who experienced this isolation during adolescence, this critical period, they had more than twice the number of lever presses. They were much more addicted to that cocaine. This other study that was showing how, oh, disruptions in your connection with other people might lead to increased addiction for cocaine. But this study, the more that you take cocaine, then that can influence oxytocin. And specifically, it decreases the amount of oxytocin in the hypothalmus's bi directional. This other study oxytocin taking that together it's like, okay, disruption. Somehow your oxytocin system and social development inc, likelihood that you'll get addicted to drugs of abuse. And separately if you take drugs of abuse, that disrupts the oxytocin system. Those are just two ways that a downward spiral can occur. But this shows that oxytocin, well, if you can get a boost of oxytocin in this case when they're looking at methamphetamine is a different drug of abuse that can reduce the effects of methamphetamine. Specifically, they looked at meth related physical activity. If you've ever seen someone or interacted with someone on speed or other amphetamines, like they're really active, they're running all over the place. So like that's one of the less obvious markers. They did that because that's a really easy thing to measure, like how far this rat runs around. If you give them an injection of saline, just salt water. Okay, That's the control condition. They don't really run around very much. If you just give them oxytocin and saline. Well, they don't really run around very much either, maybe even a little less. They're just, you know, kind of calm if you give them methamphetamine. Well, yeah, they are a little hyper and they run around a lot. But if you give them methamphetamine plus oxytocin, then it significantly reduces some of those effects. That's the behavioral, but like what's happening in the brain, like in these reward and learning circuits like the nucleus acumbens, when you give someone doesn't really have much effect in the nucleus cumbs activity. Or if they give them oxytocin, just a generalized boost of oxytocin doesn't have that effect on the nuclear succumbentsh. That seems like a big effect when you give someone an injection of methamphetamines. Boom, huge increase in oxide in nuclear succumbs activity. That's one of the reasons why it's addictive. Because your brain is like, oh my God, I don't know what that was. Do that again. And that is one of the things that leads potentially to addiction, or at least makes it an addictive substance. But if you give a combination methamphetamines plus oxytocin, then yeah, there's still a big boost, the nuclecummins activity as much. In that sense, it's just a bit less addictive. The other good news is other study found that if you inject oxytocin, then it stimulates production of oxytocin in the hypothalamus. Oxytocin has a lot of these beneficial effects of it leads to more of that could be described as an upward spiral. I don't know, just pulling a phrase out of thin air. But you can see like how these things interact, that if you experience isolation rejection, say as an adolescent or teenager, when your brain was going through this critical period where you weren't accepted by your peers or you didn't have friends or you were bullied, well, that's going to affect your oxytocin system. It's also going to change how responsive your brain is to drugs of abuse, making it more likely. You'll try drugs or find them rewarding, or more likely that you'll abuse drugs. Not definitely just turns up the likelihood a little bit compared to someone who didn't have those experiences. Unfortunately, the more that you take a lot of these drugs of abuse, the more they disrupt the oxytocin system. And that's why it creates this downward spiral. But the good news is that, sorry, did you have a questions with this regulate system history of drug use then? If they were to put down drug use, does that regulate? Yeah, so you can have changes like your brain is still malleable, like your current circumstances change a lot of that reactivity. So a lot, you know, a lot of these various brain circuits can recover. But one of the interesting things about habits is like when you've created a really strong habit in the dorsal stratum, those connections are still there. And that's why it's very easy to fall into that habit of drug addiction. When you get stressed or overwhelmed or distracted or whatever. If you start to create other positive habits habits, those positive habits can potentially become stronger. But your propensity, perhaps falling back into those old habits is still there. Because those old connections are still there, waiting to be reactivated. Yes, if you don't activate them, maybe over time they get slightly weaker. But this is one of the reasons why, like if you were addicted in the past, well, it's very easy to reactivate those patterns and fall into them. But once you know, detox and get off those substances and start creating more positive habits and positive relationships, then yes, absolutely you can be happy and motivated, and successful and productive. Just it's helpful to be careful of that tendency that your brain has. So what can you do with this information? Or rather, how can you modulate your own oxytocin system, whether you feel like I have this tendency or like, oops, yeah, you start to rely on drugs and alcohol to regulate my mood a little bit more than it might be helpful. Well, there's a few simple ways of doing it. Talking to people, more specifically having deeper connections with people. We'll talk about this more, I think next week, but like we release oxytocin the most when we feel vulnerable and that the other person shows that they can be trusted and supports us through our vulnerability, right? So if you make an admission like, I don't know, do you ever just like worry that the UCLA admissions, like they made a mistake and like you weren't supposed to get in. Like you don't really belong here. If you said that to a friend and they said, oh yeah, I know exactly what you mean, I feel the same way the whole time. You had a moment of vulnerability and then they showed through their reaction, their compassion, that you could trust them. And therefore, you release oxytocin and that makes you more bonded more closely together. It also releases oxytocin in them because when someone is vulnerable and shows that they trust you or that they rely on you and need to, that releases oxytocin in you as we saw from some of the other studies. Well, that might not always be good. If you don't like people to rely on you or trust you, then that might make you not like that feeling. And if you respond or if your friend respond with whoever, can't keep track. But if you're like, hey, I feel this way and you're vulnerable and your friends like, oh, I think there's something wrong with you, you should probably go to psych services. Well, that's supportive but like it undercuts what you're trying to get from them and that's not going to make you release oxytocin and strengthen that relationship or feel good. In fact, it might make you more averse to telling people those kinds of things in the future. And sometimes people are vulnerable with us and because of our discomfort, oh, we say something is we're trying to be helpful. Oh, yeah, you should go to psych services, but that might not be what they're looking for. So it's a complex issue, but you don't release the same level of oxytocin when you're talking about things that don't really matter. How far away from UCLA do you live like? Okay, Right. You know that's information, but doesn't have the same emotional weight to it. And therefore neither of us are going to release as much oxytocin. And sometimes we do that because it makes us feel safer. Great. But it comes at the expense of, well, we don't form deeper relationships and don't wire ourselves for more oxytocin. Making new friends can help. But really deepening the relationships that you have can have the biggest impact. Physical contact is great, like get a massage. Generally be physical, you know, hug people like high fives, whatever you know, with your teammates. Like great. That helps bonds teams together as long as it's consensual and it's just right, well, if you hug people who you're deeply connected to, well that's probably going to have an even bigger effect. You could get a Hugs boostoxtocin in a variety of ways, One because of the physical contact, just like soft fur and like yeah, bootocinw because when you're walking with a dog, people might react to you differently than if you don't have a dog. And then they smile at you or they're playing with your dog and they talk to you like, oh that boots oxytocin three. Because a dog trusts you and you have power over it, and it trusts you to not abuse that power. And the studies have shown that the more that your dog looks at you, makes eye contact with you like, oh, is this okay? Or like the more that they are looking to you for trust. Oh yeah, go ahead or whatever. The more it boosts oxytocin in you. So it's not just the physical contact, it's also the trusting relationship. Then lastly is this idea of practicing gratitude, which is fantastic because gratitude is something you can practice on your own. You can write thank you letters, you don't have to send them, and it boosts your oxytocin. Sometimes, depending on our experience of oxytocin, we don't like that because it makes us feel vulnerable. It makes us remind us that we need things so that we need other people or that other people can hurt us. Even practicing gratitude is not just always going to make you feel better, but it does boost oxytocin. This brings me to this broader discussion of our drives to form relationships with other people. Because we have multiple motivations in doing so. Oxytocin is one element that connects us to people or motivates us to connect or interact with other people. This is also called suppressin because there's a chemical suppressin that binds the same receptor, um, that is sometimes more active in men, but we can think of them as interchangeably because they bind to the same receptor. Oxytocin makes you feel attached or connected, or trusting of someone that's different than feeling attracted to them. You could feel attracted to someone, but not deeply connected. And vice versa, if you a deep attachment to someone, but no attraction. Well, that would probably be a good friend or a family member. If you feel a deep attachment and a strong attraction, well, that doesn't necessarily mean you're crushing on them or anything. Because we can be attracted in different ways. We can be attracted because of someone's humor. We can be physically just find them attractive. We could be attracted by their ideas. But the sense of attract someone looking at someone or enjoying interacting with someone that is driven by dopamine. Dopamine, yeah, it does interact with oxytocin, but it's a different drive. Then there's wanting to have sex with someone which may or may not be connected to any of these other things. We normally think of lust and attraction as going together. The attraction is mediated more by dopamine, and the lust is more mediated by sex hormones like testosterone. One of the ways you can understand this intuitively is perhaps like if you've ever been at a party, you may have had this experience. Or you've seen other people have this experience where they're like, oh, I'm going to hook up with the hottest girl guy tonight. And it's you know, 11:00 and they're chatting up everyone and then it's like midnight and then it's like 01:00 A.M. and they're drunk and drunker and then like their beer goggles come on. Their standards get lower and they're just like by 02:00 A.M. it's like, I'm fine just hooking up with anyone. Right at the beginning, it's about lust and attraction. You want to lust after someone you are attracted to. But at some point, if that, as time goes on or you get drunk or more stressed or more needy or whatever, well then the physical attraction to that person doesn't really matter as much. There's illustration of how those two things can be separable. Ideally, yeah, interact like they do interact with each other. But not necessarily like in a predictable, easy way. So, but it is helpful to realize like, oh, these things are different but they can't interact because sometimes you're in a relationship with someone, and in the beginning it's driven mostly by lust and attraction. She's like, oh my God, I just have to be around this person all the time like you feel it's addiction. That's why like falling in love with someone or being in a new relationship feels like an addiction. If they don't text you, you feel really anxious and then you have to have to text them right back. And whatever you feel really needy, you couldn't really live that way your whole life. Because it would disrupt you from your other friendships and your other goals and everything. But it is something that helps us, you know, first get that connection. But over time, well, there's more trust and more reliability from that person. Oxytocin plays a bigger and bigger role. And because oxytocin plays a bigger role and reduces our Amigdula reactivity, There's less stress that this person is going to leave, or there's less uncertainty about how they're going to react. And sometimes we experience that as like, oh, well, you know, it gets boring or stale or you know, the sex isn't as exciting or whatever. And a lot of times people interpret that as like, oh, this is the wrong relationship. Like there's no relationship. It is so exciting and now there's something wrong with it. But really, it's just evolved into a different stage. And if what you want is an exciting, fun relationship, great, go for it. Break up with them. You're young, you can do that. Nothing's wrong with that. It's just that. Mm. If what you want is a deep, trusting relationship, well, it's not going to always look like the first three months of a relationship. And like, it's fine if you want different things at different parts in your life. Like if you're 21 and you're like, I just want to date people who have fun and great go for it. But maybe when you're 31 or 35, you're like, oh, I want something different now. And that relationship feels different than I'm expecting. So it's not something wrong with the relationship, it's just different. And this is why, you know, people who have been married for 15, 20 years or whatever, they have to figure out ways to keep the relationship fresh. They got to, you know, go do different things and they have a different challenge. Ideally, in a good long term relationship, you have, you know, all three of these things going on. But It's not a given. Particularly the more that you take someone for granted and stop trying to accomplish some new experiences and so on. A neuroscience aspect as well. Of course, some deeper aspects that are going on in the brain. In this particular study, they showed people pictures of people they were in love with versus someone they were just close with. And they found that the anterior singulate, we're more strongly reacted to looking at someone you are in love with. Because it just draws your attention more the codate, which is part of the stratum. Yep. That activated more as well. Because being in a deeply passionate relationship should activate more of our habits because we are more habitually connected to this person. It also showed big increases in the VTA, or the ventral tegmental area, the region of the brain stem that produces dopamine. You have lots of oxytocin for this person, but it's not just a brief flash of dopamine as well that's modulating the brain stem region that's producing dopamine in the first place. And so it's having all these widespread effects throughout the brain, these motivational effects to connect with them. It's just that when we compare love, longer term passionate love with just sexual desire. Sexual desire has greater nuclecumbens and hypothalmus and a Migdolaa reactivity. Because when we're just talking about someone who you're, you have a crush on, or you're just starting a new relationships uncertain. And that stress is exciting, but it also really is more dopamine. And unfortunately, sometimes we think there's something wrong with our longer term relationship or it makes us, people seek that excitement outside of their long term relationship. There's also increases activity in the insula. Not surprisingly, like your heart beats faster, you feel butterflies in your stomach. Then finally, this region of the brain we haven't talked about, we haven't talked about before, but we will talk about more later. It's called the temporal parietal junction. It's further back between the temporal lobe and the parietal lobe. This helps you process your sense of self. When we see someone who we are in love with, it activates the same brain region that we use to normally just understand ourselves and what is us versus what is someone else. Now I alluded to this idea earlier of this difference between sexual desire versus being in love and long term relationships. And this has effects on whether or not someone cheats and whether someone is monogamous. One aspect of, one way that scientists have researched this topic is by looking at these two species of voles, which are like prairie dog or mole or something. But the ones that live on the prairies are monogamous and the ones that live on the mountains, the montane voles are not. They have different levels of oxytocin receptors that the prairie voles have more oxytocin receptors and they form permanent bonds, whereas the montane voles don't. This illustrates some aspects in humans, like human women, with certain genes for the vasupressin receptor, which also is activated by oxytocin. Well, they are more likely to cheat. It's not like you can just do genetic tests on your girlfriend. It's not quite that simple, but if you have certain genetics, we then just increases the likelihood of cheating. Dopamine also plays a role because study found that men with a gene for lower dopamine receptor sensitivity, they might have a lot of dopamine floating around. They're just not sensitive to it. They're more likely to cheat as well, but also be more promiscuous. That is, to have sex with more partners. Why? Well, because your brain is trying to get more dopamine. And so if you're just not sensitive to that dopamine, then it requires more dopamine to feel like you have the same amount. And this might be, you know, if you're in a committed relationship and you have these tendencies because you have these genes, well then that passion or attractiveness or lust in their relationship cools off a lot more quickly. And seeing this other, you know, hot new thing who watches in the door, like ooh, gives you that boost of dopamine that your brain is looking for or just new partners overall. Because novelty activates the dopamine system. So just noticing your own sensitivity to dopamine can be really helpful. Because you have to ask yourself like, what is your goal? Is your goal to do what's most exciting at the moment? Or is your goal to be in a committed long term relationship? And that answer might change at different points. So just be honest with yourself about what you're actually looking for in your own tendencies. Thank you.

Week 6 Lecture 2 (Lecture 12)

Okay. So percent Okay. Welcome back. Just FY the off hours for this week are going to be shifted a little later. I have to go to a parent teacher conference. Just standard my kids are well parented, don't worry. But it's going to be at 03:34 30 this week. And then actually next week, post announcement. But next week, just as a heads up, there's not going to be any lecture on the Wednesday before Thanksgiving, and there's also going to be no office hours. Oh, this week, starting this week and going into next week, you're going to be doing your own intervention. For the weekly intervention. So hopefully you've been thinking about it a little bit already. But tomorrow in discussion section, you'll have more opportunity to talk about it and finalize your ideas. But if you haven't thought about it at all, I'd really encourage you to do it. So it was somewhat random. That just reminded me I took a class, cognitive science in college. And on the syllabus there was a note that like, oh, your paper is due on some week. And so I, I saw that and I'd been working on the paper and the professor was like, oh, by the way, next week your syllabus is due. And like 75% of the students were like, what? There's a paper? And so that's why I always try to remind you of things that are there. But the thing that made me laugh was we had to write, we had to write a paper about a specific illusion. Because it was a cognitive science class on perception. And this one guy raised his hand and he's like, hey, you know that thing where you have like two fingers here and you move it and you go like that. And it looks like one finger goes the other professors like, yeah, he's like, could I write a paper on that? Just it's a reasonable idea. But it was just, it was a good demonstration in the middle of a big lecture. So you can come up with your own intervention, whether it's practicing magic tricks or listening to music, or practicing yoga or journaling of some kind, or anything that we've talked about in this class or things that you are curious about. Those are the best places to start, because you're going to have to do this anyway. You're going to have to do a write up. So you might as well do an intervention that you are interested in. Yes buddy. If this is the thing that you find most fascinating, go ahead, write your paper on that. But yes, we have to explain why you chose a specific intervention. No, you don't have to explain why you chose it, though. You will have to connect it to some scientific reference. This is one of the things that makes things. Science is the humble approach that you don't know everything and that's what makes things science is by connecting it to other stuff, or knowledge or research that other people have done. If you just come up with some idea, sure you can test that. But one of the things that science, or puts it in the realm of science, is trying to connect it to other research ideas that other people have studied, have evidence on. So I would say that probably almost anything you can think of, there might not be a specific huge study on exactly that. But you could connect some pieces of it. You know, like if I wanted to do an ultimate frisbee intervention or whatever, like there might not be a specific paper on ultimate frisbee, but I could connect it to research on team sports perhaps. And then I say my specific hypothesis is, I think it'll be exactly like these results when people play soccer or, and rugby. I just am investigating to see if ultimate frisbee is going to be similar. So in science, like you do need to connect it to previous stuff, but it's got to be different in some way. Otherwise, why are you doing this study when it comes to something you are doing on yourself? However, you can actually follow some protocol that some other research study has done. If there's a study on journaling or a study on whatever, you can do the exact same thing that they did. Because the unique variable, in this case the independent variable is you go. This tends to work on college students or this tends to work on whoever does it work on me. So you don't need to come up with some totally brand new intervention. But this is to say like if you're just following your curiosity and like, oh, that would be so cool. I wonder if, like, you know, I've heard that taking cold showers is really helpful. Okay. We'll just do a little extra work and see, is there some scientific research on that that you could connect it to and just spoiler alert for cold showers? Yes, there is. There's also research on saunas like there's lots of stuff. This intervention will span two weeks. Ideally, you should have it be a little bit more rigorous from your previous weeks because you've written about limitations that you've had in previous weeks. One of the things that we do with that is not just to like, oh yeah, we should do this differently. Well, if you're continuing to do science, if you can change some of those limitations and make it better science, then you should do that. Are there any questions about that Wednesday? No lecture on the Wednesday. Yes, you have Monday lecture before, one week from day you have lecture. You'll talk more about this and what makes a good intervention in discussion section. In general, the easiest, the easiest way to think of something and also the best thing scientifically is something that follows a similar structure to what we've already been doing. Most of the interventions are like, oh, you do something for 10 minutes or write something for 10 minutes. If your intervention that you came up with was, oh, I'm just going to smile or something, I'm going to smile more or whatever. Well, if you find that, let's say that there isn't much of an effect on just smiling. Say before you go to bed, what you don't know, Is it, is it that smiling doesn't help you or is it just that, oh, the change you made in your daily routine was so tiny that you can't really see the effect, and that it's not easy to compare it to the previous interventions you did. You've already collected a lot of data on yourself. You've done a lot of experiments on yourself. You kind of have a good idea if you make some change in your day that's about 10 minutes long. Well, if that thing is meditation or it's writing about gratitude, or it's, you know, being on social media, you kind of have an idea of how much a ten minute change in your day would be. So if you make a change that's smaller than that and you don't see an effect, then you can't know if it's that specific thing exactly or if it's just it wasn't a big enough dose, so to speak, to be able to have an effect. So I say this because sometimes people have ideas that are really small and little simple things to do because they're curious about them and that's fine. That's good. Just think ahead of time about how you would interpret that data and try and figure out how to make it more comparable to previous weeks. Um, sometimes students are just trying to think of the most minimal, simplest thing they could do just because they don't want to do as much work there. I would say, well, you know, that's probably not a good design. But also that's why I encourage you to, as long as you're going through this exercise and doing this class, like take a few moments to think about what are you actually curious about here. You're getting credit to discover about something about yourself that you could potentially use for the rest of your life. So yeah, people come up with lots of cool, interesting ideas. Today, we're going to continue our discussion. Yes, there's a discussion on Tuesday. Yes. Tomorrow. And a week from tomorrow, we're going to continue our discussion about the social brain and the social aspects of well being. And really dive deeper into how our well being is very much connected to our relationships and connections with other people. That it's not always something you can just solve entirely on your own. This study looked at the prevalence of depression as it related to a variety of different factors including social support and loneliness. Essentially, this is the difference between loneliness, being alone, the amount of social support or social integration you have, is the degree to which you are not alone. But that is different than a feeling of loneliness. Which is a feeling not a behavior or an obser, objectively observable thing. This is just showing that these two aspects of loneliness and being alone can both affect levels of depression and can also interact. When we look at this graph, we see that feelings of loneliness, the more lonely you feel. Starting from the left, people don't feel lonely at all. On the right, they feel extreme levels of painful and intrusive levels of loneliness. The more lonely you are likely you are to experience depression. The more integrated you are into your community and into the groups that you're in, the more social support and social connection and social interaction that you have. Well then, yeah, you still feel as lonely. It just means that loneliness doesn't trigger as high levels of depression. So it's the people who are feeling extremely lonely and who don't have that social support. They're not integrated into social networks at well as well, who have the highest levels of depression. And what this research and other research shows is that the feelings of loneliness and social isolation, or rather being alone, are independent risk factors for depression. We sometimes think of them similar, yeah, you're more likely to feel lonely when you're alone. But they are independent risk factors because one is a or an action or a set of behaviors. The other feeling, that feeling might trigger certain behaviors, or certain behaviors might trigger or influence certain feelings. But they are independent and you can probably understand this intuitively when you think about your own experience of if you've ever, you know, been by yourself in your dorm room, maybe you're wrapping a Christmas present for someone, or you're like writing, you know, a birthday card to someone, or you're sending someone an email. Like you are physically alone, there's nobody near you. You're not talking to anyone. And yet you could feel very connected to the people in your life. This is one of the things that the gratitude letter sort of illustrates whether or not you send it to anyone. You are not communicating to anyone. If you don't send it, you're just sitting there by yourself writing a letter. And yet it could help you feel more connected to other people. It reduces feelings of loneliness even though you are not actually less alone. Conversely, we probably had, you've probably had this experience where you're at a party or some event where there are many people, dozens of people, perhaps hundreds or thousands of people, people. Or you're walking around campus. You pass people all the time, and yet you might not feel connected to any of them. You might feel out of place, you might feel awkward, you might not show it. You might, you know, talk to people and be really social. And other people are like, oh wow, that person's so connected wherever and you do a good job of Um, integrating yourself socially and you have high social skills, but you might feel isolated and alone and disconnected. So that just shows you how those two things can be independent. Yes, they can influence each other, but they're not always the same. Sometimes the solutions to our problems or when we're stuck in depression or other issues, sometimes the solutions are figuring out ways to be less lonely or feel less lonely. Sometimes the solution is to figure out ways to be less alone. Sometimes it's a combination of the two. U, um, social skills also can play a role in this. This study was done on was 118 high school students who were moving at least 200 miles away to college. So that means whatever support networks of people who you normally interacted with in your regular life, you're going to have to create new support networks. You're going to have to integrate yourself in a new way in this new place. They created this graph in this study, showing the relationship between stressful life events and change in depressive symptoms as a function of people's various levels of social skills. I'm not exactly sure how they assess social skills, or perhaps it was a self assessment. But what they found is when there are high levels of stress and it doesn't really make much difference at low levels of stress. But at high levels of stress, the better your social skills, the more it protects you from depression. Because these social skills are helping you create new social networks or integrating yourself into social networks. And this is a really important skill to have when you are uprooting yourself and going into an entirely new environment where you don't know anyone. Does anyone have any questions or other observations about this graph? Um, as to, you know, what happens over here in the negatives Like, I don't know. I don't like why don't these numbers just start from zero science when we're doing studies of real people? Real people are complex and so there might be multiple things going on that we're not necessarily looking at in this study, but like for example. Anyway, these lines are just, well, they observed people. And you can draw a line through their data and come up with a line. And that can make predictions that some of these are more easily interpretable. What I just described is what's going on over here. That if you have high social skills, it buffers you from some of the harmful effects of stress. Yeah, yeah. For the axis. How exactly are measuring depression? Stress. Depression is likely measured through, I'm not sure what specific scale they use, but it's usually just through a questionnaire of like, do you meet these various criteria of depression? This is often how depression is diagnosed also. I mean, when I went to grad school I was like, there's got to be something we can measure about the brain that'll tell you whether you're depressed or not. And it turns out like maybe you can, it's very high, you can't really diagnose. It's easily, it's much easier and cheaper to just ask someone just takes 30 seconds. You could diagnose yourself with depression. There's nine question, you know, item questionnaires. So that's just what they're doing there. The stress, I imagine, is a questionnaire about stressful life events. And they're just saying how many stressful life events? So interpreting this graph over here is a little bit easier, like what's going on over here. I don't know. When you're showing a line graph, you're not showing the underlying individual data. So it's important to remember that any line that makes it look, oh, there's a nice clear trend, is just a summary of individual data points of all these different people. And you could put yourself there, have you experienced lots of stress, whatever, It's going to be a noisy cloud of dots and there's just some nice lines that might best explain those data, but as to why. They, you know, sort of go negative here and have that different relationship. It's possible that A, there just aren't that many people over here. Like most of the people who go, move 200 miles away to go to college are at college. Well, most people have some higher level of stress. So even though there's yes, technically a line there, we don't know enough about those people to model them well or understand them well. Maybe it's, they're trying to fit a straight line to something that actually has an exponential curve to it, I don't know. Or it could be that there's something different about these people. These people who like don't experience any stress about moving 200 miles away. Well, if you move 200 miles away to go to college, like, I don't know, it seems like that should be somewhat stressful. And if you don't experience that as stressful, maybe that says something. Your brain is wired differently or your attachment styles are different and therefore your relationship between social skills and depression might be different. Anyway, the overall point of that is like yeah, you can sometimes get understand the main point of a graph and a takeaway. But when you actually think more deeply about it, sometimes that opens more questions. And if just going back to this slide, you might be like, huh, well I wonder what's going on with these people over here. Okay, well you could then do another study on those people or, and that's essentially how science is built. I keep wanting to emphasize this point over and over again, that we think that science is just about finding the right answer. And memorizing, you know, what is correct and not correct, but what science actually is, is looking at some data, being like, I don't know, this seems to make sense. Oh, this kind of makes sense and it fits in with this theory. What the heck is going on over here? I don't know. What do you think? Well, maybe it's because of this and you're like, I don't know, maybe because of this. And there's only one way to find out, which is by doing an experiment. So the reading that we're going to be focusing on most this week is focused on communication. It's not directly about social skills per se, though, I think it will certainly enhance your social skills. And we're going to be this book, Difficult Conversations is extremely useful, not just for doing well in this class, but hopefully you'll find it really useful for communication in all various areas of your life, including your friendships or your work relationships, or in group projects, or on teams, romantic relationships, whatever. Communication is so important because it's essential to healthy relationships. As individuals, we have different experiences, different perspectives. And it's often nice when it feels like somebody else is always on the same wavelength as you, so to speak, are always on the same page. And they can kind of read your mind, you never have any conflict and that's awesome and wonderful when it happens. It's just unrealistic to think that that will always happen all of the time. There's always conflict or disagreements or misunderstandings in relationships and communication. The ability to sort through those things are essential to maintaining those healthy relationships. One of the key takeaways from the book and one of the key takeaways that you should have take into your life, is that if your goal is to communicate something, whether it's an idea, or a thought, or a feeling, or whatever, communication, whether communication has taken place, is a function, not about what you say or what you communicate. It is about what the other person hears. Either in a literal sense, like they just didn't hear what you said. Because you have, like I said something, right? But if they literally didn't hear what you said, then you can't say that communication has taken place. You said something, but they literally didn't hear it. But it's also not just about a literal sense of hearing the words, it's also their understanding of what you mean. So if I say, hey, there's, you know, office hours next Wednesday are Going to be at 03:30 instead of 02:00 Well, right that I said that. And if you showed up at office hours next Wednesday and I wasn't there, you'd be kind of annoyed because you were, like you said, office hours next Wednesday at 03:30 Yeah, that's what I literally said. But did you understand next Wednesday to mean the next Wednesday that is occurring, which is this Wednesday, or did you interpret that to mean a week from this Wednesday as in next week's Wednesday? Uh, so like that is very crucial if your goal is to communicate. To just understand that basic concept. Like if my goal is to communicate because I don't want you guys to show up at the wrong times for office hours. And you know, one because I like talking to students, two, I don't want to have to respond to all the e mails of people like, where were you? But that's why it's crucial if my goal is to communicate, to make sure that you understand what I said. It's not enough for me to be like, well, I said next Wednesday and they have to interpret that to understand what I am saying. Whether we are effective in our communication is influenced by a lot of things, including the mood and the perceptions and the intention, and the impact of ourselves from the other person that you're trying to communicate with. If have a good relationship with someone and if you're both feeling good and you're just on the same wavelength, then communication is often effortless and easy because it feels like you can read the other person's mind. There are very few miscommunications, but we're not always so lucky. One of the main takeaways from the book is that part of the reason that those miscommunications can happen or why communication is sometimes so difficult is because when we are talking with someone, we're having a conversation that there are multiple conversations occurring at the same time. It is not just the literal words that are coming out of my mouth, it is also how you feel about the words that I am saying and how I feel about the words that I am saying. And the actions or world events that those words represent. And my beliefs, and you know, my beliefs that I have about our relationship. Okay, I'm a professor, you're a student, you should listen. And it doesn't matter if I go off on a tangent and I'm boring, like, you should figure out what I'm trying to say. Okay, well if that's my belief about what a good student is, well, then it might change how I communicate. You know, if your belief about what it means to be a good friend, or a good boyfriend, or a good son or good spouse. Well, your belief about what that means might be different than the belief that someone else has. And that can lead to miscommunications because our words can be interpreted at many different levels. And we'll talk about this next time in discussion section. But just briefly, I suppose I should define like what a difficult conversation is. A difficult conversation is any conversation where when you think about having it, you can sense like Matt. I'd rather not like you. Your insula, your interceptive awareness is probably really helpful in telling you what a difficult conversation is when you're like, oh, should I have a conversation with my professor about like I'm not going to be able to turn this paper in on time? Or should I have a topic, a conversation with my boss about like they might be engaging in sexual harassment? Or should I talk with my, you know, girlfriend about I don't like the way she does whatever. Like if it was easy conversation, you wouldn't really have much thought or emotion around it, you just do it. But if the thought of thinking about talking with someone about a intimate, close relationship, or a job interview, or a political conversation where you feel like, oh, there's going to be disagreement and tension. And I don't know is it worth it to talk about it or not. Those are all examples of difficult conversations, ones that engage our emotions in a potentially stressful way. And these conversations are complex because as I said, our language is interpreted at multiple levels. There's the literal level of what happened, like, well, I said Wednesday, I said it, I didn't say Wednesday. You said, well, you didn't say next Wednesday. You said next. We often get in arguments about at the surface level of like, well, you said you, we'd have lunch at noon, Here it is, It's 1204 and you're just sauntering in the door. Like you didn't say 12, like we scheduled lunch. That's a perfect example of difficult conversation because like, has anyone seen the show? Curb your enthusiasm? I feel like it's a great example of a lot of these because there are a lot of situations where it's like, you're not wrong, you're just an \*\*\*\*\*\*\*. And sometimes we're trying to figure out, we spend all our time to figure out like I am I the hole here am I like we spend all our time and energy trying to figure out and we use what happened as evidence of one thing or the other, so. Well, I said 12:00 they were gonna have lunch at Telve o'clock because we all understand that 12:00 means around 12:00 Not exactly 12:00 We're friends here, you're not grading me on my performance to arrive at a certain time. We all understand that there's traffic, that stuff comes up, whatever, like Yeah, I got here, 1204, that's my belief. Your belief is, oh man, this guy, he always says he's gonna do something and he doesn't do it and follow through. I don't even know I can trust him. He's not trustworthy. He doesn't value my time. Every time I get here at 11:55 because I'm a good friend and a good friend doesn't make their other friends wait so they respect other people and both of us can be correct. And we can look at the time and say it's 1204 and we can like, you know, maybe my watch is slow or fat like we could argue like oh, but all my watch says is 1201, whatever. Like we could argue, we often spend all our time and energy and effort talking about these surface level things of like we did we say, you know, 1204 or did we say around noon, what is the actual time? And we are avoiding talking about all of the things that actually make it a difficult conversation, which is, well, how did you feel when I showed up at 12:04 Or how did I feel when you criticized me for showing up at 12:04 Or what does this say about our relationship? That I would show up at 12:04 when we agreed on 12:00 Or what does it say about our relationship that you would even bring up the fact that I showed up at 12:04 Judge, because I'm like, well, a good friend is someone who lets things slide when they're not that big a deal. So here you are making a big deal about me being 4 minutes late and this is, you know, over exaggeration. But you've probably been in similar situations where you have a long term relationship with someone and finally something boils over because it's the last straw. And so we make these things more difficult than they need to be because we don't actually focus on the conversations that are actually happening here. We don't address what is actually happening, which is the feelings that I have, the feelings that you have, and the beliefs about what that says about me as a person, what the beliefs that says about you as a person. And many of the circuits that we've discussed already play a role in this. So I think we've covered this slide already. But this was showing an example of the power of expressing your appreciation and expressing gratitude. This was a study where they had people write down, sorry, thank you, letters to people. They didn't never have to send them, but just on three occasions they sent or they wrote a thank you letter. And everyone was going through psychotherapy, but some of the people did this little thank you letter intervention and three months later they scanned their brains and they found that the people who just Did. This little gratitude exercise had significantly more activity in the anterior cingulate cortex when playing this little gratitude game. The anterior cingulate, which is a key part of the attention circuit, it's a key part of your brain that tells you, hey, like you should pay attention to this dude, this is relevant to you. Oh, it activated more when good things happened to them. Because they had trained their brain to pay attention to those things by taking action and expressing their gratitude. So this is one of the things that happens in relationships that you're in a good relationship with someone and you just sort of take them for granted because they're always there and you're always consistent, you're always on the same wavelength. And then we don't express our appreciation to that person as much. And that can sometimes get in the way because it makes it easy to take that relationship for granted even though it is an extremely important relationship. And so maybe I've been out of shape because I'm 4 minutes late and you never appreciate, you expressed your appreciation for the fact that I drove 45 minutes to get here. Yeah, I'm 4 minutes late. You live across the street. You just walked over here. I drove through 45 minutes of traffic. And that's what this conversation is really about. That you never express your appreciation to me. You're just harping on me because I'm 4 minutes late. But appreciation can have a very powerful effect, not just on the other person in the relationship, but just on you, like in making you feel more grateful. And it's a very powerful thing to practice, but it also does benefit other people. Like you can write your little thank you letter and you can really appreciate our friendship and congratulations if you appreciate it, I appreciate, you know that's wonderful. But it doesn't really impact the other person unless you express it to that other person. And this study just showed, um, people going through the FMRI experiment where they could either win money or get positive social feedback when they did this little task correctly. We've talked before about how the nucleus recumbence activates when we say win money in a gambling task. Well, they found that the Raul, sorry the nucleus recumbence is also activated when we get positive social feedback. This is activating basically the same region as when we win money. So expressing your appreciation to someone else saying thank you, saying good job smiling at them. Whatever positive social feedback you want to give them is like a checking account where if they do something you can just give them money and they're, oh, that's going to activate their nuclear incumbents and make them feel rewarded and valued. Just it's like a checking account where you don't have to withdraw anything because you can just keep telling people how great they are. And that does, unlike money, it's not like depleted. And yet it feels sometimes like it costs us something to say something kind, there's a risk there. And this is a lot of what difficult conversations is about, or understanding this whole process is about. But you have the power like, okay, you could give someone money and that activates their nucleus of commons. Or you could give them, say, something positive sometimes that can have an even bigger effect. One of the other more powerful things that we can do in our communication or relationships with other people is nothing to do with what you say. In fact, to stop talking, stop focusing so much on what you are saying, and instead, listen, because as I've mentioned earlier, communication is less about what is said and more about what is heard. Sometimes we are focused so much on o, well, I'm saying this aspect, that yeah, that's a part of communication. But if nobody is listening, then communication is not occurring and you could blame the other person for not listening. You're welcome to do that. But is your goal to blame the other person? Or is your goal to ensure that communication has taken place? And oftentimes, nobody is willing to listen until they feel heard that their communication is being effective. And you, by virtue of being aware of this, you can volunteer to be that person who listens to actually facilitate communication taking place. This is also a real way to benefit somebody else. This FMRI study showed that being listened to increases activity in the nucleus. Incumbents, nucleus sucumbents gets activated for many things. It's part of the reward reinforcement circuitry. When we win money, we see, oh, when we get positive social feedback or someone smiles or tells us we do a good job. But also when someone is just really listening and engaged. So when you guys are all sitting here and nodding along and smiling, I feel that reward. I want to thank you, want to express my appreciation for that. You have the power to do that with your friends, with other people you're communicating with, when you're just like looking at your phone or type. Uh huh. Uh huh. Yeah, yeah. Well, you're robbing the other person. You might be listening. You might technically be listening, but you don't appear as if you're listening. And like the other person doesn't know if you're listening or not. All they know is whether you seem to be, what do you look like you're listening? And so this is the key thing here is that it is looking like you are listening that activates the other person's nucleus incumbents. This also leads to a lot of arguments and difficult conversations. That someone you might be having a conversation with your significant other or a friend and you're on your phone or whatever, and you're listening, you might actually be listening to them. And they might say, you're not listening to me. And you can argue, they argue, kidding. And you could just pair it back, everything that they just said to you, because maybe you technically were listening. But does that usually work in a relationship like, gotcha, I was listening, You thought I wasn't listening, but I was? Well, you might be technically correct, but the other person doesn't necesarily feel supported by that. Because that, again, is focusing on the what happened conversation. Were you listening or were you not listening, as opposed to what are the emotions behind why this person said what they said? Oh, they didn't feel like you were listening to them. They felt like you were treating them as if they didn't matter. That's one way that we can help communication and help other people. And you have a guess as to what this big United States looking blob is over here? Any part of the brain? Insula. Yeah. So that's the insula. I don't know like we have the insulas on this side. I don't know why it's not bilateral activation. But again, we're not really focusing on right or left differences here. But when someone is paying attention to you and listening to you, it activates the insula. We feel things more deeply. When someone is actually paying attention to us, it feels like, oh like what I'm saying matters are treating me like I matter. That sometimes gets in the way because like depending on the connection between the insula and the migdal or the rest of the Olympic system or how we interpret our own bodily emotions, sometimes it can be too intense for someone to be paying close attention to us and we're like, oh, this guy's like paying such close attention to me, it makes me feel uncomfortable. And by the way, sometimes that can be accurate if someone is, you know, creepily paying attention too much to you. But the point of the matter is somebody paying close attention to you increases feelings. Whether they are good feelings or bad feelings or those feelings get in the way of other things, that's a separate point. Also, one of the benefits of listening is that it keeps you from saying something stupid that could potentially make the relationship or the communication worse. Similarly, sometimes the best way to show your appreciation or that you care about the other person. Is to just shut up for a second and not point out the obvious mistakes that they have made. In other words, to withhold criticism that when I show up 4 minutes late for our lunch, we both may have known that I just drove 45 minutes to get here. I might know that I'm 4 minutes late. You might know that I'm 4 minutes late. But if you just like shut up about it, just like, hey, it's so good to see you like I will. I appreciate the fact that you didn't point out a nitpick about my little mistake that I will experience that as a kindness. Just because something is technically true does not mean it is helpful or kind to say it's important to recognize as a two way street. That sometimes we feel like we want to point something out because it's technically true. Hey, I'm glad you're here, but you know you were late. Uh, it's important to realize like our desire to focus on what is logically true or not true, or correct, or incorrect is driven by our own emotional needs. Yes, it might be technically true that I am 4 minutes late, but your reason for pointing that out was driven by some emotion you had about the fact that I was late? Because if it was irrelevant, well, there's millions of things in the world that are true, that are irrelevant. Like there's a tree, I don't know, There's like ten trees on Westwood Boulevard. Okay. True. There's sycamore trees, right? Those are true. They were planted like eight years ago. I like Okay. There's some true facts about those trees that we could talk about that are extremely irrelevant to anything that we're talking about here. So if I showed up to lunch and you'd be like, hey, you know what, there's eight trees out there, there's sycamore trees. Did you know that it's true? Is it relevant to anything? Well, that's a different matter. So, but sometimes we like to hold on to the fact that like, well, what I said is true, which is not actually the reason why we said it because well, there's a reason you specifically chose the fact to point out that I was late. And you didn't point out the number or type of tree that is on Westwood Boulevard because that is also equally true, it is whether something is relevant or not, either to me or you, that has to do with your emotions and your beliefs. So one of the ways that I found really helpful to think about this is with the phrase like, is this just something I want to say? Or is this something that they need to hear if I showed up late to lunch? Well, you might feel like you want to point that out. But just take a moment and be like, oh, am I just wanted to point that out because like I want them to feel bad that they're late, or is this actually going to be helpful either for the relationship or to make sure it doesn't happen again or whatever. And this can help you avoid a lot of unfortunate self imposed communication errors. Is this something that would just feel good to say or is this actually something that would be helpful for them to hear? Um, and this aspect of avoiding criticism, feeling like maybe we deserve to be criticized, but then someone doesn't criticize us. That also activates the nucleus accumbens, activated the same part that is activated by positive social feedback, by winning money. We see the nucleus accumbens down here, avoiding feedback. A negative feedback. In this case it was, I'm doing some game. And either they can be like an ant or, you know, a big frowny face or something that tells me that you suck. You did that wrong versus I'm playing the same game. I realize I made a mistake, but you're just not pointing it out every single time I make a mistake. And when we experience that **aspect of avoiding criticism, it activates the nucleus comes.** That feels good, smiling. Uh, is another great way to communicate. This is just sort of a broader way, a more specific way of saying the broader idea of we don't just communicate with words. We communicate with our facial expressions and our posture and our actions. So yeah, words are one thing, but the tone, the facial expression, the timing of the words, you know, everything else that you are doing is also contributing to communication. But smiling is a particularly simple way to communicate. And it is infectious in a way that someone else is much more likely to smile at you if you smile at them. And we'll talk in a moment about why that is. But I use the word infectious intentionally. Because our positive emotions and our negative emotions, our emotions in general, are infectious to other people. Or contagious in particular ways that mirror how, say, viruses or other infectious diseases are contagious, they can spread through a social network. This study was done on a really big data set. They've been collected over many years. And part of what they were collecting was people's happiness levels. You know how happy are you, how sad are you? You know what good things or bad things happen to you. They found that mood was contagious throughout these social networks. If someone you are closely connected to gets happier, well then that kind of infects you and you're more likely to be happier. And then the people that you are connected to who may not even know that original person who just got a raise or a book deal or whatever, they become happier also because you got happier because of that person. And so we're constantly, based on our moods, pulling the people around us up or down. And that in turn, pulls on whoever they're connected to, up or down. And at the same time, we are constantly being pulled by all of the connections and the close people in our lives. And that's one of the really powerful ways that something as simple as a smile can help, is because you just smile at someone. They don't know everything that's going on in your head, but they know they might experience that as a kindness. That makes them feel better, that makes them more likely a smile. This is just one of the ways that you can have this non linear impact around you. Because how you are can infect the people around you. This, by the way though, is unfortunate. Sometimes working in the opposite direction, where people say with depression can often feel like they are a burden on the people around them. And they're like, I don't want, I don't want to infect you, like I don't want to pull you down with me because we understand our effects on other people. This can also sometimes present a problem because we often need that social support. And often your concern about, well, I don't want to pull down these other people overlooks the fact that, well, they want you to rely on them. So this isn't always a necessarily positive thing. This is a description of how human social connections work. In particular, though, um, certain emotions or actions to elicit emotions are more contagious than others. For example, seeing other people do good things is contagious. It's a process called moral elevation. When you see someone do something nice for someone or donate, like you feel good, you're like, oh, people are generally good out there. There are a lot of You know, Youtube videos I'm sure you could watch, of people doing nice things for other people and just you just feel better about yourself. Research shows that when you look at videos of people doing good things, it acts both the parasympathetic nervous system and that it's sort of calming and the sympathetic nervous system because it's exciting. It's interesting strange effect. It also activates the medial prefrontal cortex. Um, because thinking about whether someone is doing something kind or not really depends on our understanding of why we think they are doing it. Like if you see someone donating to charity and they're like, hey everybody look at me, I'm donating so much money to charity. You may be like, oh, they don't actually care about that. They're just trying to make everyone else feel good about them and they're just trying to get attention and that wouldn't make us feel as good as someone who we saw, someone who didn't have any money, who wasn't trying to draw attention to them, and we felt, oh, well, their intentions are good. And we'll talk a lot more about this later. And the connection between the medial prefrontal cortex and our belief about other people's attention, sorry, intentions. But it is those intentions that matter because it's our belief that someone intended to do something good that makes us good. Or our belief that their intention was something less than virtuous that makes us not feel good. This study, that medial prefrontal cortex data isn't shown here, but this other study asked people to do money. They were given money and they were given the opportunity to either donate it or keep it for themselves, and these were for real charities. There was a further the twist of sometimes this was in the presence of another person who was watching them make this choice whether to either donate money to charity or keep it for themselves, or it was in the absence of someone observing them. When they looked at the behavior and what people were actually doing, they found that just having other people observing you increase the likelihood that you would donate to the charity. That's just a behavioral result. When we look at what's happening in the brain, we see that the choice of whether or not to donate in the presence of other people influences what's happening in the nucleus accum. We can look at the dark bars here. You're given this money and say, hey, do you want to donate to the charity, or keep it for yourself and somebody is watching you. Yeah. You're more likely to give the money to the charity, Why? Well, because there's greater nucleus accumbens activity on average, it feels good to give that money to the charity Because perhaps, you know, oh, this other persons think I'm good or they'll smile at me or whatever. There is less nucleus accumbens activity when you choose to keep it for yourself. Why is it not none? Ah well. Because you get money. So money activates the nucleus acumbens. It's just that in this particular instance, giving money to charity has a greater impact, on average, than keeping it for yourself. What's really interesting is what happens in the absence of people looking at you, as far as the nuclear sucumbins is concerned? For the people who keep it for themselves. I E not donate and nobody's looking, oh, well that has a bigger increase in nuclear sucumbons activity because now you just get to keep the money. And nobody thinks portly of you because nobody's watching. So that has a bigger increase in nuclear succumbs activity. And that's part of the reason why, when no one's watching, you're more likely to keep the money. What is going on here though, is interesting. It's basically average is close to zero. There's not really any change in nuclear incumbents activity when people choose to donate money, even though nobody is watching. Why is that nuclear decumbs activity close to zero? Because it says this behavior is mediated by some other part of the brain. It's not as easily explained like oh well you felt good so you did it. It's not related to what is going on in the nuclear incumbents. People still do it, but it's a more complicated, broader issue. Now some of these aspects of how we relate to other people and how infectious their emotions are, and how they affect us, and how we affect them are related to something called the mirror neuron system, which was first discovered in this experiment in monkeys. I believe it was somewhere, I think in Parma, It was a hot summer. And they were doing some experiment where they were from specific cells in the brains of these monkeys. The cells, which cells? When they activate, they cause the monkey to move. It's just that the monkey was also paralyzed, so that they wouldn't move while doing this experiment. But they just wanted to record from those cells in the brain. And then this researcher came by the experiment and he was eating a gilato, as they tend to do in northern Italy in the hot summer months. And as he went to eat the gelato, he's just watching the experiment. The monkey's brain started activating and there that's weird, like normally they were recording from an area that was involved in movement. But the monkey wasn't moving. It wasn't even trying to move at that moment. And so he took another bite. In this area of the monkey's brain activated. This was their first understanding of this mirror neuron system. Most neurons in your brain either respond to perception or sensation. Something stimulates them from the outside. Or they are what's called motor neurons or part of the motor system in that they are sending some output to the rest of the body. So they're either usually input from the outside world, or output usually motor output that is moving your muscles or moving your body. What they found is a subset of motor neurons that they are involved in doing a certain action. But they also activate when you see somebody else doing that same action. Because they are involved in you doing that action. You perceiving someone doing that action prompts you or makes it more likely that you would do that action. This is one of the ways that we learn behaviors from other people. We just copy and mimic this automatic unconscious. If you are playing sports, we learn by watching other people doing things. And that activates the same brain regions that would have you do those things. Importantly, they encode intention. So it's not just like a specific movement, rather a behavior which is a movement with a certain intention. If you were say, trying to learn how to throw a frisbee and how is teaching you how to throw a frisbee? Why I could throw with you. And you would start to copy my movements and how I threw it. On the other hand, if we're just talking here, there's no frisbees involved and I'm just like doing this and you're like, what the heck is he doing? I have no understanding of my intent or whatever. Like there's no behavior to copy. They studied this in these monkeys in that if the researcher moved the ice cream to his mouth, the monkey's brain would activate the, If you just sort of like moved the ice cream like this, in some bizarre pattern, like why would you do that? Then the monkey brain wouldn't. It was activating to you're moving something towards your mouth to eat it. There are human studies that have found that when we disrupt the mirror neuron system that it disrupts imitation. I just want to take a moment to explain that there are individual neurons that are mirror neurons that you could record from that are both involved in perception and movement. In humans, though it's very hard to record from the brain, we often talk about the mirror neuron system or brain regions. That appear to activate both for perception and action. I show you know, a sequence of piano keys to play. Most people, oh, you can copy that sequence. You can play those notes. If I show it to you, and also give you a little magnetic pulse to disrupt that mirror neuron system briefly, then you aren't as able to readily just imitate behaviors. This brings me to this, this idea that we have many different ways of and communicating with each other. The mirror neuron system is what's most closely related to this concept of empathy. That when you see somebody else get hurt, it activates your mirror neuron system and so you feel unpleasant and different people have different levels of reactivity of their mirror neuron system. And some people have really highly reactive mirror neuron system. You see someone get hurt, makes you feel really bad, other people are less reactive. But the key aspect of this is that empathy is that a feeling somebody else's suffering. That is distinct from this other process that we'll talk about in a moment called theory of mind, which is about understanding somebody else's thought processes and perspective. That's about understanding what somebody else is going through. Oh, I see that your hand is stuck in that car door. Oh, that looks really painful. I can totally get while you're screaming, like that's different. That's a different process, brain processes like, oh my god. Oh, that's terrible. Okay. Now, both of those things, uh, are different than you taking action on that. Like hey, let me open that car door for you so your hand isn't stuck anymore often. They are related in that what often happens is that we see someone's hand gets stuck in the car. We see that they're in pain, let's say. That creates an empathic reaction or a mirror neuron system. We're like, oh, I don't like this. We realize, oh my God, their hands stuck in the car door. Oh, I totally get that. Oh, if I just open the car door, then they would be in less pain, and then by virtue, I would be in less pain. And therefore, that motivates me to take action and open the car door and solve the problem. And that I'm calling compassion or acting compassionately. But it's just important to recognize that these are distinct things that empathy is about, feel sympathy or validation is about understanding, It's a cognitive process. And compassion is about taking actions. And sometimes they are related, but sometimes we get in our own way because we're like we won't let ourselves take action because we don't feel bad enough. Or conversely that we think that our feeling bad is sufficient. But when it comes to your suffering, you probably don't care if I feel bad for you. You probably care if I'm willing to do something about it. And this is how we often miscommunicate a lot of ways and inadvertently tell someone else that they aren't important to us or that they don't matter, even though we feel like or think that the matter because of this aspect of mind reading that we all do and are all good at. You have a representation in your brain of other people and they have a representation of you. And you have a representation of what you think their representation of you is. This is how we can do things like play chess, for example. Well, I know then I'm going to move here. And I know if I move here, then I can shift perspective and imagine, oh, well if I was you and I moved there, then I would do this. And then we can shift back like, okay, well if I know that he knows that, then I'm going to do this and we're amazingly good at this, and you can make your chest move based on that little conversation you have with people. Oh, I know this. So I'm going to do this. Oh, I feel bad thing that because they know how bad I feel and they're going to feel good about me and whatever. That's a great feature of the human brain that we can call mind reading because we're very good at trying at understanding 99% of the time what someone else is doing and why they are doing it. It's just that it's only so great until it's tragically or comically wrong, kind of like a GPS navigator that. 99% of time. It works perfectly and you just follow it without thinking. And then, oops, you end up in a lake, or you end up on a dead end road, or a road that doesn't exists. And what happens if it's your GPS? You would realize, oh, the GPS was wrong. What happens when it's your own brain, however, is because you are so good at understanding other people's motivations and intentions that you don't even realize. A lot of times when you are wrong. For example, can I just borrow this right? She has no idea what I'm talking about. She doesn't even really understand why I'm doing. Thank you. That was the demonstration. I looked at her. I sort of gestured, can I borrow this? She intuited that I was talking about her. This guy didn't react at all. She didn't do anything. Why? Because it wasn't looking at them. Right, Judge. So she tried to read my minds based on oh, why? This guy's walking over to me and reaching out to me and looking at me like he must want something that I have. What could that possibly be? She picked up her pen first. She picked up a piece of paper. I have no idea what this guy wants. She offered them both to me, but that all happened simply like from the words, can I borrow this, right? So we're so good at mind reading and assuming people's intentions that we don't even realize they were doing it. And 99% of the time it happens totally seamlessly and we have no awareness. Occasionally though, we have miscommunications. And when we have miscommunications, because we are so good at it, we automatically assume, well, there's something wrong with the other person, or they did something wrong or there's something wrong different about the situation. We don't jump to the fact, oh, maybe I made an assumption about their behavior about myself that isn't actually accurate. But this idea of mind reading, I think it's really well encapsulated this movie, The Princess Bride. Did I ever to see The Princess Bride? There's great scene with Wallace Shawn where he's this evil guy and he's against the man in Black. And he takes, the man in black has proposed a duel of wits where he puts poison into one cup of wine. He switches them around and the other guy has to guess which one he put the poison into. And Wallace, Shawn says, but it's so simple, all I have to do is divine. From what I know of you, are you the sort of man who would put the poison into his own cup or his enemies? Now, a clever man would put the poison into his own cup because he knows that only a great fool would reach for what is given. I am not a great fool. So I can clearly not drink the wine in front of you. But you must have known I was not a great fool. You would have counted on it. So I can clearly not choose the wine in front of me. And we can make these u, sort of little chess games in her head like, oh, I know this, but then I know that. You know, I know this, and that's one of them. We're amazing at it. This is a more explicit example of that. But because it's so automatic, sometimes it creates a problem. It's also important to recognize that some people's brains are just more cooperative than others. Like some people's brains are more likely driven by the empathy and the mirror neuron system. And they'll just go along with the tone and the emotions in the conversation. Other people, they're looking for inconsistencies or errors. And it's really important to understand yourself and what kind of brain you have. And it's also really important to understand what other people's brains are and how they respond. So we'll watch this video at the start of next time. But this is just a summary of the theory of mind system that these two systems we have to understand other people are largely the theory of mind system, which is understanding what someone else is thinking and why they are behaving as they are. And also to understand our own minds. And then there's the empathy system or the mirror neuron system that just caused us to feel what other people are feeling in these. Both systems are crucial for our communication and connection with each other. So we'll go into that in more details next time. But yes, thank you and thank you.

Week 7 Lecture 1 (Lecture 13)

Okay, so we're going to start, whoops, what happened? That, what happened? There you go. So we're going to start with this video. There's no sound, so you're not missing much. But just to watch these shapes and decide what you think is happening here or how you would describe it or even might sound strange to notice how you feel about it or anything that is occurring. Okay, awesome. Oops, try this 22nd bedtime ritual. No, don't try this 22nd bedtime ritual, or I don't know what the bedtime ritual was, but yeah, so oops, I didn't want to do that. Would anyone like to describe what they saw happens in that video? I'll just set this up all the How about, would anyone like to say what they thought? The big triangle. So did you have a dot laughing? So he said that the situation reminded him of a domestic disputes which elicited laughter because obviously that's a difficult situation, it's not a laughing matter. But it is kind of funny to describe what is happening with these triangles and circles as such big, emotional, emotionally charged terms. Would anyone hazard a guess as to what did the big triangle do at the end of that, by the way? Just as a description. Yeah. So the big triangle broke the box. Would you describe what was the big triangle feeling when it broke the box? Why did it break the box? So the circle in the other triangle left and so that's why the big triangle destroyed the box. Okay. Yeah, but if you were just guess why I broke the boxes. Okay. He kept trying to get the circle in the triangle. Oh, I kept trying to attack them. Yeah. Right. Last part, right? Yeah. Yeah, they left, I guess the triangle got all upset. Yeah. Right. So one way of viewing is like, oh, he was like they were excluded from the other way. He kept trying to do the wrong thing. What would anyone describe the little circle like, how is the little circle feeling when it was sort of like cornered in the box? Yeah. Look scared, right? Why would you have said it was scared? Because it corner, Yeah. And it was sort of like the menacing quality of like the box closing slowly, the big triangle came in and like closed the door slowly and like approached the little circle like judge and we were laughing here because we can see, and this is a general point, the absurdity of what we're talking about here, like these are just circles and triangles moving around a screen and moving into a rectangle. And the rectangle lines move. But you can very easily understand like, oh, well, the big triangle is bigger than the little triangle. And if that was me being cornered in a room with no other exit, like I would feel scared. We can interpret the intentions or the mindset of why these shapes did what they did and how they must have felt and some of that. Is just automatically felt by us like the menacing triangle moving in and slowly closing the door. Like some of you, I'm sure sort of felt like a little uncomfortable about that. That's the empathy mirror neuron circuitry activating to this little circle shaking in the corner because you know, it's not even in a conscious process. You're like, I would feel that way if I was cornered by someone bigger than me. You just have an automatic, empathic mirror neuron system response. But the other part of this is understanding their motivations, why they do what they do. And that is a more cognitive process of theory of mind where we try to understand someone else's intentions. I sort of mentioned it last time, we didn't have time to go into it deeply. But the theory of mind is the ability to attribute mental states that other people's intentions or their beliefs or desires. What someone else might be thinking, even to your self. You can see someone's behaviors that's more observable and objective. Just like in these triangles, you can see what the triangles are doing. But the simplest way to describe what the triangles are doing are actually to make this big leap. We say oh, well like the one triangle like opened the door and then went in and then it chased the other triangles like, no, it didn't do any of those things, it's just triangles moving around. But we are so automatic at attributing mental states and intentions to other people. We can do it with anything that appears to be having human like behaviors. And it's so automatic that we don't even necessarily realize we're doing it. No, the big triangle did not chase the little circle. It was moving and the other little circle was moving. But like the little circle wasn't running away from, it has no beliefs about, or feelings about danger. But that is sort of the simplest way that we describe it because we are so adept at theory of mind, um, we can see other people's behavior, We can only guess at the motivations or intentions as to why they did it. Like if a kid knocks their, you know, milk off the table. Oh, did they do it because they were clumsy? Did they do it because they were really excited and distracted and didn't notice? Did they do it because they were trying to upset you? Well, all you can see is, you know, the milk is on the floor and you have an automatic mental representation of why they did it. And then subsequently, you have an emotional reaction likely based on your assumption about why they did it. We don't actually care is going a bit further than just the simple theory of mind, but we don't actually care what people do. We care about why they do it. If someone stepped on your foot, knowing nothing else, you might or bumped into you on the street, you might get annoyed. You might be scared. But depending on why you think they did it, your emotional reaction can change, knowing nothing else. Your automatic reaction might be sort of habitual. If let's say you're angry, I'm like, watch where you're going, buddy. Like, don't bump into me. If you look over and then you see, oh, this is, you know, a veteran and they only have one leg and they tripped and fell into you, you would no longer likely feel angry at them. You would probably apologize, Oh my God. I'm so sorry. Can I help you? The exact same thing happened, but is your belief about why did this person do it? Did they do it because they don't care about me. Did they do it because Of some other reason. Like just, you know, if someone, if you saw someone do some boneheaded move in traffic, you might get really angry or upset at them. If then you noticed, oh, they're driving their, you know, pregnant wife to the hospital, or they're having a seizure. Like oh, boom. Like the behavior and the action is the same, but the mental state behind it is completely different. And your interpretation of why they did what they did is what largely dictates your emotional reaction. And we don't even realize that we are doing this because we are so fast automatic at doing it that we have an emotional reaction. Don't even realize it is just an assumption that we are making about the person's beliefs and intentions that may or may not be correct. Just some silly examples or smaller examples of theory of mind. This is a classic experiment that researchers show to kids, because kids don't really develop this ability until they're a few years old. And it continues to improve over, let's say, you know, there's Sally and Ann, And Sally puts her ball into the basket, and then she walks away an takes the ball out of the basket and puts it in the box. And then Sally comes back. Will Sally for the ball? Anyone want to guess where Sally is going to look for the ball? Yes, in the basket. Why would she look for it in the basket? That's where she put it, and then she left. So, you know the ball is not in the basket. I see the ball is in the box, but I also know that Sally does not know that because she wasn't there to see it. And that is sort of the smallest, simplest form of theory of mind. You have the ability to take other people's perspective, to understand that different people have access to different information. And there's a point in time where kids will see this and they'll say, oh, in the box, because they know it's in the box. And at some point, they start to realize like, oh, Sally wasn't there, she doesn't know. This is also the point in time where kids start to learn how they can kind of lie because you as a parent can come in and be like, did you eat that chocolate bar? And they could be like, oh, you weren't in the room, You don't know that I ate the chocolate? Like, no, I didn't eat the chocolate. They're usually bad at it because their face is smeared with chocolate. But it's actually a sort of a sign of development of the brain, these prefrontal circuits that allow us to see things from different perspectives. There's some research that showed people cartoons. That cartoons can be funny for a variety of reasons or mildly funny for a variety of reasons. These researchers put people in FMRI machine and wanted to see how the brain utilized theory of mind in understanding these various cartoons. Some of these cartoons were only funny because you had different knowledge or a different perspective than the person in it. Like this far side cartoon I believe is funny because you can understand, like this guy's like, why is there this piano stool here? And it's funny because you know that he's about to get hit by a piano. Funny in quotes here, but funny adjacent. But that is sort of activating your theory of mind system or this. They're like, why are these two scientists covering their mouths? Well, they appear to be giggling. Why are they giggling? Oh, because they put a black marker on this telescope. And this guy now has black around his eyes. And so he doesn't know why are they laughing at me. So these things to be able to understand people's intentions and different perspectives utilize theory of mind. Whereas these cartoons of just like oh the three blind mice, like taking their glasses off, or these women, these are leading towers of pizza by the way. They are throwing away the straight ones. That is the go again humor adjacent. But this is less about perspective taking or understanding someone's intentions or beliefs. And when we contrast looking at these different types of images in the inside, FMI, ones that require you to take someone else's perspective or not. It activates the medial prefrontal. And the **medial prefrontal cortex,** or the medial prefrontal cortex in general, is the part of the brain that we use to understand someone else's perspective. Or even to differentiate like what is our perspective versus someone else other's perspective or to even understand our own intentions and beliefs. Hi, wonder why I did that. Yeah, so that was the summary of what we didn't get to you last time. In the brain, the theory of mind is not driven solely by just one brain region. The **dorsemeal prefrontal cortex** is a key part of it, but it's more helpful to understand it as a network of regions that are crucially important in this. The dorsemeal prefrontal cortex is one of them, the temporal prietal junction, which we had talked about when we talked about, that's also a part of it. Well, we talked about it in love by the temporal prietallobejunction, that is involved in processing your sense of self. When you're in love with someone, you kind of make less distinction about whether you're happy or they're happy. Like, how can you be happy if the person you're in love with isn't happy? So there's less of a distinction between those things, but the temporal prietal junction processes sense of self. And therefore, it's similar to our related to our theory of mind to understand like, oh, is this something I know or something I'm thinking or something I'm believing, or something I'm feeling, and that's separate from what someone else is thinking or feeling or believing. Some scientists try to differentiate, well, there's specifically the theory of mind versus just social cognition, things that we do to interact with other people. And there's pretty much a huge overlap in all of those regions. There's also an overlap with something called the default mode network, which is not something we've discussed before, but the default mode network was something that was identified in FMRI studies when they were doing a lot of early FMRI studies. And like, I wonder what happens in the brain, what our areas are active when you do this gambling task, or what areas are active when you do this whatever task. What some researchers notice is, oh, that's weird. Like regardless of whatever task you have people do in the scanner, whether it's a gambling task or a spelling game or whatever, there are certain areas that always decrease their activity when you're doing the task. And as soon as you stop doing the task, they go back up in their activity. And they called these the default mode network because it appeared that these regions we're always active. And whenever you did some very specific task, then they turned off. And it turns out as we got better at understanding the theory of mind system, that those are basically overlapping regions. The regions involved in the default mode network and the regions involved in the theory of mind network are basically the same ones. And one interpretation of that is that our default state is just kind of thinking about and reflecting either on other people or about our own thoughts and intentions. And as soon as we start doing something like hey stack these boxes, hey pick this, whatever, oh, then those theory of mind things shut off and we start focusing on whatever the task is at hand. This also kind explains this interesting phenomenon. You may have noticed that like if you're really busy or you're rushing to finish a paper and your roommate comes in and like slams the door and is like making noise, whatever, you're probably more likely to think. But they're distracting me from writing this paper or you might not even notice them at all because you're under this time pressure to finish this paper. Whereas, if you weren't in the middle of finishing the paper, you were just sitting there scrolling your phone and they did the same thing. You might notice or wonder hi. They seem angry. Like they seem upset by something. You might ask them about that. And that's because when you're not specifically engaged in a specific task, you more easily activate your theory of mind circuitry and you notice other people's intentions and actions when you are very committed and focus on a specific task. You are less likely to notice other people's intentions or wonder or be curious. And in fact, you're more likely to see other people as obstacles to those goals that you are trying to accomplish That sometimes gets in our way when we start to see the people in our lives as obstacles and that are preventing us from accomplishing our goals, because most people don't like to be treated that way. But we've talked about the two main systems involved in our connections with other people. And I just wanted to highlight some of the key distinctions, this theory of mind system versus, versus this empathy response that's mediated by the mirror neuron system. This particular study wanted to try and disentangle. They showed people either videos or had text describing a specific action because they wanted, the reason they did both of those things is because they didn't want to just see like, oh, is this a part of the brain that responds to videos or to text? They're like no, like the text and the video are representing the same action. So they're trying to understand the abstract information as opposed to like, oh, is this just consumed by video or not? And then they had people consume that content in one of two ways. Either to focus on how the person was doing this behavior or why the person was doing this behavior. So when they looked at the videos, they, you know, you could see someone moving their hand across a textbook, holding a highlighter. How's she doing it? Oh, well, she's holding this highlighter. She's highlighting the text, moving from left to right. That's how she's doing, what she's doing. Is she doing what she's doing? Do you think someone would move a highlighter across the textbook? Any guesses? Yes. Yeah. Oh, they want to signify the information is important, that's why she's doing it. She's not just coloring in a textbook. Like if this person was, you know, a four year old and they were doing, you're like, oh, they're just probably just coloring a textbook, this person you're like, oh, they're probably highlighting that information because it's relevant to the class. You could say, oh, maybe because she's interested in that information. Or you could say, oh, maybe because she knows the information is gonna be on a test or whatever. Like you can come up with various scenarios of why this person would do it. You have no idea what is going on this person's head or even if they're just, you know, moving their hand back and forth. But you very easily and automatically come to an assumption about why that is the theory of mind system in action. That's contrasting with the mirror neuron system, which encodes how someone does something. The theory of mind system is a cognitive abstract idea. The mirror neuron system is more concrete. It is more related to physical movements. A lot of times we haven't talked about really the premotor cortex. But the premotor cortex is the part of your brain that prepares you to make a movement. It's part of the frontal lobe. It's just not part of the prefrontal cortex in humans, most of the frontal lobe is the prefrontal cortex. Like, I don't know, 80, 90% of the whole frontal lobe is prefrontal cortex. Doing all this cool stuff that we've talked about this whole quarter. But parts of it are the motor cortex, which is if you stimulate part of the motor cortex that say represents your arm, then your arm will move. Sorry, the left brain represents the right arm. So I stimulate the left motor cortex. My arm might move, my leg might move. The pre motor cortex is preparing to do that. So if I said, okay everybody, when I say go get ready to raise your right hand, okay? So some of you did it, so some of you didn't do it. But the preparation. Oh, I'm going to raise my right arm that is activating the premotor cortex. And then as soon as the trigger of the stimulus comes, oh, then it tells the motor cortex like yep, now it's time to raise your arm. For some of you I think had probably no intention of raising your arm, so you probably didn't activate your premotor cortex at all. Some of you maybe had an intention, but you got confused as when you're supposed to do it, and so you just didn't activate the motor cortex. Some of you activated both sequentially, the minar system also. And this idea of encoding, how is also part of the prefrontal cortex, but the more concrete parts of the prefrontal cortex that are literally, like, focused on like, oh, like how do you throw a baseball, how do you throw a frisbee? Oh, well, okay, I move my arm here first and do this. They're more concrete and tangible, whereas the theory of mind system is a more abstract cognitive idea. It encodes why we talked about the Dorsi medial prefrontal cortex and the temporal prietal junction. But also when we're thinking about why there's also the orbit of frontal cortex which is involved in motivation and decision making. Because we're like, you know, like an actor. Classic example of an actor. You have the line like, oh, what's my motivation? Your motivation is that it says this character says that, That's say it. My wife is the writer by the way, and she's always like, just wish I could tell you, just say it, I wrote it. That's why you say it. But that's why writers are not directors but like the motivation of like, right, why are you saying this? And there can be more abstract, distant causes. There can be more sort of proximal concrete causes. And it's just that the more tangible and concrete, the more it's, you know, just involving the mirror neuron system. So the motivation say can be like if you came home and you saw your roommate drinking a beer and it was 11:00 A.M. on a Thursday or whatever. Like hm. You might be like, huh, Like how they're doing it so well. They walk to the fridge and they grabbed the beer and they open it. And like part of you might be like, oh yeah, that sounds good. Let me do that too. And like we just monkey see, Monkey do is the classic example because that's how the mirror sentaron system work. We're more likely to do things that other people are doing. But the theory of mind system might wonder, I wonder why they're having a beer at 11:00 I don't usually, is something go wrong. Do they break up with their significant other? Did they fail a test? Like, I don't know. You don't know either. You just walked in the room. But the theory of mind system is wondering about their motivation, oh, are they thirsty? And they thought that was a lacroix and it turned out it wasn't lacroix. Like there are bigger or smaller motivations of why people could be doing the ventrilateral. Prefrontal cortex is also involved in this. It's just that there's parts of it that are more concrete and parts that are more abstract. Just going back to what I had mentioned last lecture about empathy versus sympathy or validation. The mirror neuron system is involved in empathy. That you can just feel someone else's emotions. If you've ever been in a situation where someone just, they seem really angry and you're just like, ooh, I feel uncomfortable. Or they seem really stressed and anxious and you can just like feel it oozing off of them and it just makes you stressed and anxious. You have no idea why they are stressed and anxious. You might not even be aware consciously that they are stressed and anxious, and yet it can still impact you. And some people have mirror neuron systems that are more responsive, some people have mirror neuron systems that are less responsive. When I describe that scenario of someone being stressed and you feeling stressed as a result, if you have no idea what I'm talking about, well then you probably have a mirror neuron system that is less responsive. Sometimes we could interpret that negatively as like, oh, that person's less empathic. They don't have empathy. People have different lower levels of reactivity in a variety of brain circuits for a variety of reasons. It is very helpful for you to understand yourself though, like oh, am I the kind of person that when someone is stressed or scared. The kind of person that, oh, I feel it really deeply and it becomes so overwhelming, the emotions become so overwhelming in me that I can't even think straight. Or am I the kind of person that, you know on the flip side, am I the kind of person that like, oh, I don't, I don't even notice that they're frustrated or upset or stressed or whatever, or like, oh, maybe you're somewhere in the middle, but it's not better or worse to be one way or the other. It's just that's how your brain is what makes it better or worse, or gets in your way of your goals or not, or creates problems or not, is your lack of awareness of how your brain is and then the subsequent actions that result. So some people have lower automatic emotional reactivity, but if they recognize that about themselves, they can, oh, oh, I know I need to take a little bit more mental effort to remind myself, oh, this person looks upset. Oh, let me think about why you can create a habit of being sympathetic and trying to understand on a cognitive level, why someone is thinking or feeling the way they are, even if you don't have a lot of emotional reactivity. Conversely, sometimes people are so emotionally reactive, you've probably been in this situation sometimes either with a friend or your parents or whatever, where you were upset and you said something or you didn't even say something, they just felt it. And their emotional reaction was an exaggeration of your emotional reaction. You're like, oh crap, like I was going to ask this person for help 'cause I told them I'm struggling, you know, whatever. And I asked for help and then they got so upset, Oh my God, are you okay? That like now I have to deal with my own emotions and now I got to deal with other person's emotions too. In that sense, yes, that other person is being very empathic and very emotionally reactive. But sometimes that gets in the way of actually thinking rationally through something or being able to support someone. This connects to what we had talked about with attachment. Like it's good for the parent to sense the stress or distress of the baby. Like oh, something seems wrong with the baby. Oh, I wonder what it could be. So the empathy triggers the sympathy and the theory of mind circuit. Oh, maybe they are hungry, maybe they need their diaper changed. It's fortunate when they're a baby. There's just, you know, you just go through the checklist whenever you have kids. Sees you early on. I just like Okay. Well, it's either they're hungry, they're tired, they need to change the diaper, they need to be held, or it's nothing, and you can't do anything about it, and you just sort of go through those things. But if your emotional circuitry is very reactive in general, you really don't like feeling out of control, for example. Or when you're out of control, it activates your Olympic system really strongly and you are someone who has a very reactive mirror neuron system will Then this baby being upset could make you very upset and stressed out in a way that makes it harder for you to calm the baby down because the baby is upset and now you're stressed and upset too. And now the baby is upset because you're stressed and upset. And this is sometimes what gets in the way of secure attachment. Ideally to form secure attachments, the parent should react to the baby's needs, but not overreact And make things worse, or not underreact and ignore them. And it's impossible to always exactly perfectly react and match someone else because you don't know someone else's behavior. But as long as you are, you know, aware of your own emotional, emotional needs, your own emotional reaction, then it's easier to match the needs of the other person, whether it's a baby or a friend, or a partner. And that's why the biggest predictor of whether or not someone's going to form a secure attachment is whether the parent has a well developed theory of mind. Because if they don't have a well developed theory of mind, well then the baby's upset, they feel upset, and then they get angry at the baby. The baby's trying to make me upset, I suppose like oh, just triggering their theory of mind like, oh, the baby's upset. Oh, I am also upset as a result. Oh, I'm upset because I don't like being out of control. Okay, well, let me just take a deep breath and then. Tend to the needs of the baby. So these things interact with each other. And it's just helpful to recognize that you might be high in one and low in the other or whatever. Like we might have different habits of activating them. But it's crucial to understand what it is that your automatic way of being is. It's also really helpful to understand like, well, what is called for. What would be most helpful in this specific situation, like when you go to see the Dr. Yeah, we want the Dr. to have some empathy. Like if you had these migraines, like it'd be nice if the doctors like, oh that sounds terrible like one, they don't actually need any empathy to say that sounds terrible. They just need to sound like they're being honest. Like you don't actually care if your Dr. really feels your pain. You just want them to validate your experience. That's a sympathy they want to use. Oh, migrate o, that's terrible, right? But you don't need to feel bad internally yourself in order to tell someone else or, hey, that sounds terrible. You don't need to be able to take their perspective to understand the situation they're in is terrible. Yes. Sometimes empathy helps you do that, Sometimes it gets in the way. But they're separate things and in fact you don't even care that much that your Dr. how sympathetic your Dr. is, as long as they take action to help you. If you had the most empathic sympathetic Dr. in the world and they were just like, oh, I can't, I am, a lot of prescriptions can't do anything, or I'm unwilling to write you a prescription for this. Then it's like, that's not helpful buddy. I don't like thank you for your empathy, I appreciate it. But like really what I wanted from you was to act, to take action, to help me with this. And same thing happens in relationships all the time that we think, oh, my partner is telling me this problem, oh, I'm gonna jump into action. I'm gonna fix the problem and act to save it. Because that's what they want. They want me to act compassionately, and that's great if indeed that is what the person wants. But some people, they biased, they're more biased towards action. Uh, other people are more biased towards emotional connection. Sometimes what your partner wants or your friend or whoever they first want you to validate their experience, to activate your theory of mind and say, oh yeah, I can totally see why you're experiencing that. That sounds really tough. And if you react to that phrase right there that I just said as like, but that's ridiculous. If I could just solve their problem, why wouldn't I do it? Hmm. Well then you probably could benefit from utilizing your theory of mind system more or noticing your lower empathic reaction. Although it's complicated because let's say you're in a relationship and you know, Persone says had a really tough professor, they like yelled at me. Or you know, said something mean. And person B says oh, you know what you should do, You should go write them an e mail and you say this and that. Why did that person say that? Did say it because they're trying to be helpful, Or do they say it because they're saying, well, you shouldn't really be that upset, you should just fix the problem. Or you're bending this out of shape. And both people might have different perspectives on the situation. Also, you can't really, from that specific example, did have a low empathic reaction or not. Sometimes it might be that person B had a low empathic reaction. They didn't see that like, oh, that their significant other was really bothered and just wanted to be supported through this. They just said, okay, oh well I know what I would do and they just gave a suggestion. That could be one thing that's happening or it could be that person B had a very empathic response, but they did, they don't like themselves. Strong feelings of being out of control and stress. So they immediately jump of, I was feeling those feelings because now I am. I would go talk to the professor or yell at them, or do something. And they give this advice to you because they're trying to deal with their own feelings. But then person A is like, oh, you're not even listening to me, you're just, you're ignoring, you're invalidating my experience. And that's why this is a complicated thing. Because all of these things are different. They're either sort of more emotionally mediated or they're more cognitively mediated, or they're more action oriented. And we can't necessarily know from the outside. This idea of empathy also plays into our notions of fairness and punishment. In this particular study, they played something called a prisoner's dilemma game. Which is a monetary version of it where it was sequential. Where essentially you're given some money. You can decide do I want to keep it or do I want to share it with the other person I'm playing with? Then the other person gets to, did you act fairly or not act fairly in this case? The person who first got the money, they were a confederate of the study they were in on the study. So you're actually the person who is on the other side. So I get to decide like, hey, oh, I got $10 I'm going to keep all of it. We're like, oh, I got $10 I'm going to give you $5 And so you get to decide, you know, in your own mind or just have this automatic reaction of whether I acted fairly or not, and then you see me get an electric shock. And that's just sort of how the study is designed. And either I acted fairly and got an electric shock, I acted unfairly and got electric shock. It's unrelated to how I acted. But what they found is that first of all, we have empathy, we have an automatic empathic response. In this case, in the insula, for when people get shocked you're sitting because some of someone, they get an electric shock, makes your stomach squirm, gets processed in the insula. This is example of the mirror neuron system at work showing empathy, but we just have decreased empathy. Just doesn't quite activate as much for when the other person has acted unfairly. So if I just got $10 and I didn't give you any of it, and then I got shocked. Mm, yeah, you might feel bad for me, but you just don't feel quite as bad. And we see that both through decreased insula, reactivity as well as decreased anterior sculate activity. Both of these regions are involved in our processing of pain. So when you see someone else get shocked, your pain regions activate as if you got shocked unless the other person was unfair, in which case you just don't react as much. And this is different across different people. Study divided it by gender just to look at the men and the women separately in this study. And they found this is what's, where is my mouth? Whatever this is what's happening in your insula when you are seeing a fair player get shocked. So both men and women activated the insula. Similarly to a fair player getting shocked when they saw an unfair player getting shocked. Someone who was greedy and kept all the money for themselves. Both groups had decreased insula reactivity, but the men had significantly more. And one way to interpret this isn't a black or white thinking. I was like I knew it, men just wearing, is it pathic? But it's crucially important to understand that each of these bars, these graphs represents a whole bunch of people with data all over the place U. So yes, we can summarize, get summary statistics. We're like, oh, on average, this group of women and this group of men, you know, we're here here but individual people could be all over the place. So yes, there are probably some women who, you know, reacted almost just as strongly to the unfair player. And yes, there are some men who just had no empathy at all for the unfair player. But those are just, you know, these graphs represent statistical averages that like, yeah, most people were somewhere in the middle, so there's a huge Overlap. So this is one of the places where stereotypes can get us into trouble. It's not that statistical differences don't exist, it's just that, ah, that's a very different thing. Taking on average stats, subtle difference and then attributing it, oh, that's the characteristic of this group. That's the characteristic of that group. Also, it was interesting. They found that your desire for revenge engaged the nucleus accum when someone activated unfairly and they got shocked, gave you a little boost of dopamine, the nucleus Cucumbentska. Yes, that's what should happen. It feels a little rewarding. It feels good to see someone who acted unfairly get punished. Like if you ever see someone, you know, cuts you off in traffic and then they get pulled over by a copy, yeah, that's what should happen, like it feels good. In this particular study though, in this particular situation, that effect was only significant in the men. Uh, and so you could say, ah, I do it, men are bloodthirsty and just out for revenge. And it's like, well again, statistical variations. It's like, yes, on average it might be higher in the men, but I'm sure many women out there with a strong desire for revenge. It's just different on average. We also can't know from this study and it is crucially important to not make assumptions about, oh, is this some innate genetically controlled effect on the brain. We know that genetics does impact brain reactivity, but we also know that how you are socialized and how you're encouraged to behave and react, and what to think, to think about, that also affects your brain reactivity. So we can't know like, oh, is this some inherent to genetic difference between men and women? Or does this just represent the fact that, you know, little boys are encouraged to stand up for yourself and, you know, punish people who are unfair. And that, you know, little girls are encouraged more to like, oh well but think about the other person's feelings. My guess from all of the research that I've read is like, yes, there are some slight individual differences on average between men and women. And that those differences get exaggerated through our socialization process. But it's crucially important to realize like, well, you can't know that much about any individual person just by looking at statistics that describe a group that they are in. What is helpful about this is just, oh, noticing your own individual reaction, like oh, I do feel that oh, that's interesting. And the more that we can use these processes to understand ourselves better, like oh, well that's great. Just sometimes when we learn a little information about science or about some statistics, it's very easy to then start walking around the world, painting everything in a black or white brush, and start being, you know, judgmental in making assumptions about complex processes and trying to narrow them down to simple black or white things. And that's usually where we get in trouble. Our emotions exists in us for a reason. They help us survive on an individual level. But some emotions also help us survive on a group level. And they help us work better with other people towards a common goal. This is one of the reasons why our emotions are contagious through our mirror neuron system. If you're thinking back even before humans, there's like a group of monkeys somewhere in a tree. And one of them sees an eagle flying and it is scared because he sees the eagle flying towards the tree and it screams, well, if the other monkeys were just like, oh dude, with that Steve over there is just kind of freaking out. Like no. Like then they would be more likely to be grabbed by that eagle or whatever. Like when someone in your group is experiencing fear, well, the unhelpful thing would be to either ignore it or be to just like, huh, that's interesting. I wonder like you get attacked, right? The most evolutionary advantageous thing is to react to that information really quickly and then process later. Yeah. Why human experience still responsibility? I don't really understand the question. When oftentimes social groups, if you see someone is in danger, it's common for other people to feel like, well, someone else will do got so she's like human, if this is so Nate, like, why you humans have a diffusion of responsibility. Like when you see, you know, an unhoused person in trouble, or someone who is in a, you know, seems to be having difficulty, we kind of just, oh, someone else will take care of that. It really has to do with the oxytocin system or that's a big part of it, that yeah, if you saw your brother fall down on the sidewalk or your mom, you would have a very different emotional reaction. So a lot of times when human behavior doesn't really make sense in our modern society, it's helpful to realize like a lot of these situations that we're in now are very contrived and not sort of related to the way the brain evolved. Like, yeah, if you were with your tribe and someone in your tribe got injured, you should react to that. And some other random person in your enemy tribe then you shouldn't go near them. And so we didn't evolve in the situation like God, we're just surrounded by tons of people who we don't really have close bonds to. But social, social emotions are contagious through people because they help us take action together and orient towards danger or our positive things together. So things like triumph, ha, amusement, something funny, fear, oh, disgust. Even though that's a poor acting job, you can sort of recognize that these various emotions have different sounds, or facial expressions associated with them. And they engage the mirror neuron system. So in this particular study, they played sounds of these emotions for people and saw how they engaged the mirror neuron system. So this big black bar here, that's the highest, this was the person themselves making the sound. So make a sound of fear a. So they asked the person to make that sound, a motor response and that had the biggest activity in this motor region. That's not surprising. Like yeah, there's a part of your brain when you activate it and it makes you yell, right? That part of the brain activates when you yell. Not surprising. What makes these things part of the mirror neuron system is they're not just activated when you do something, they also activate when you perceive that same action. That's what showed here that like yes, these brain regions activate when you make this sound, but they also activate when you hear somebody else make that same sound. Whether it's triumph, amusement, fear or disgust. It's just that the interestingly like triumph had one of the biggest effects. And this is why, you know, it's so much more exciting to see a football game in person, in a stadium. Because that excitement and triumph is infectious through everyone. But, you know, fear also spreads through a crowd. Uh, it also correlated with the intensity of the emotion. Mild amusement or mild enthusiasm or something, or mild fear isn't as infectious. Doesn't activate these mirror neuron systems as strongly as fear. This, by the way, is also one of the reasons why it's more enjoyable to say see a stand up comedy performance in person than by sitting by yourself when other people are laughing. You're more likely to laugh because it is infectious. Laughter, though, plays an interesting part here because we laugh for a variety of reasons. Sometimes we laugh like uncontrollably. Just because something is hilarious. Someone slipped on a banana peel, whatever. You can't really control it. It's an automatic reaction. Sometimes though, we laugh out of politeness. Not like intentionally polite, but like your friend, you can tell they're really excited to tell you the story. Like oh my god, I had like my professor did the craziest thing and you just are kind of like, oh yeah, really Like what and like, you're not laughing because what they said was really funny. You're laughing. Tell them like, oh yeah, like tell me more like, hey, I'm interested to hear you. Or I can see that you found it funny. That's slightly different than like fake or simulated laughter, where I'm intentionally doing that to like trick someone. But social laughter could be either because it's voluntary as opposed to involuntary. So when someone is laughing for real, like they just bust up laugh. You could tell like they have no control over that. Like they genuinely are just laughing. When someone has social laughter though, you don't know like oh, are they laughing just because like oh, they're polite and funny and they like you and they just want you to feel good. Or are they intentionally trying to laugh and make it sound like they think you're funny and that they like you and that they feel close to you. So that is what can sometimes be described as fake laughter or social laughter. Because social laughter can sort of be real in the sense it's like, oh yeah, like tell me about your date, whatever, or it could be fake. But it's all both controlled by the voluntary action system as opposed to just an involuntary reaction. And when we hear the sort of fake or social laughter, I can play you sounds of people laughing and some are like, oh yeah, that's funny. Like what I just did, there is fake laughter or social laughter. I might be doing it with good intentions or I might not be doing it with good intentions. But it's an intentional act as opposed to real, sort of authentic laughter. When we hear the social laughter, it activates the dorsimedal prefrontal cortex and the anterior singular cortex. Why? Because it's crucially important to know, hey, is this person just like laughing because they think it's funny, or is this social laughter? So like when we hear someone laughing, it's like, oh, okay, that's not really, that's, you know, intentional in some way. And that's sort of, perhaps what the anterior cingulate is doing. It's like, oh, that stood out as, you know, sort of different than what normal laughter is. But the Dorso medial prefrontal cortex, this theory of mind system gets activated because we have to know, is this person just laughing along with me because they're my good friend and I'm telling this story that's kind of awkward and they feel bad for me and whatever like or this person trying to make me think that they are my best friend and they support me. Because if they are my best friend, then I should trust them. And this is wonderful. If they are just pretending, however, that I am in danger or this is a bad situation, I need to get out of it as fast as possible. And one of the things that creates stress is the uncertainty of not knowing. Is this person someone I can trust and therefore I can trust them? Or this is someone I shouldn't trust and I should get out, out of the way immediately I need to protect my self. This is one of the fundamental challenges of being human, is that we need each other to survive and thrive and be happy. And yet, you can't ever really know exactly what someone else is thinking. Even if you ask them directly you don't like well, they could be lying to you. You're like, are you sure I'm not upsetting you? No, no, no, you're fine, really? Are you sure? Sure. Not trying to just reassure me you can't. Actually, no. But different systems that I've described and how we connect and communicate with other people all interact. I've talked about the theory of mind system is like this is wondering why someone is doing what they're doing. Mirror neuron system is just responding directly to how they are doing what they are doing and is just reacting in a more tangible level when those two things don't add up. What someone is saying makes us think, oh, based on that, I think they're thinking this. But then the vibe that we're getting from them seems off, that activates alarm bells Because when someone truly is, you know, trustworthy in whatever and says what they're feeling or whatever, you can trust them. Then like oh, their actions and their words and the feeling that you get around them, like it all lines up and that makes us feel safe. And when it doesn't line up, something seems off. Either I'm misunderstanding something or they're trying to deceive me. And these are also influenced by the oxytocin system. Where the oxytocin system makes us feel more empathy in connection with people that we are closely connected to. It also makes us Think about those people as more, whereas people we are not connected to, we're more likely to see them as just obstacles or objects or just not be as likely to activate our theory of mind system. They all interact and inform each other. This complex graph just shows that. I can't really summarize it, because it's a three way interaction between whether you get oxytocin or placebo, and, um, you decide to help another person or punish, or whether this computer decides to help or punish you. Interpreting that as a three way interaction is very complicated. The summary though is that they do interact, just like for example, this is when you get a boost of oxytocin versus placebo. If you decide to he someone else versus punish that other person, well, there's differential activity in the TPJ, this region that correlates with your sense of self and it's part of the theory of mind system. And if the computer is making this decision for you to help someone else or to punish someone else, well then those also have different reactions as well. So this is just to say that like all of these systems are involved and they interact in complex ways. This brings us to a more deeper dive on difficult conversations. Which as I mentioned last time is like anything you find hard to talk about, we could talk about the Israel Palestine conflict right now. Anyone feel like doing that, like oh, do you feel like talking about that with anyone? Not really. Right. That's a difficult conversation or like, oh, who do you know, what do you think is going to happen in the presidential election? Well, just talking sort of surface level. Yeah. What do you think is gonna happen? That's not a difficult conversation. Asking someone like, hey, who are you gonna vote for and let me convince you you're voting for the wrong person. That's a difficult conversation, one that has potential consequences, and that is why they are stressful when we perceive that there's going to be disagreement or conflict that has consequences. Why? Because those are the things that stress us out when things are uncertain or potentially uncontrollable, but have big consequences. Either big positive consequences or big negative consequences. Asking somebody out on a date or asking someone to marry you. If you're just joking, you could say, hey, do you want to marry me? I don't feel stressed about that. No offense, I'm sure you're a wonderful person. I'm already married. But she also did not feel stressed by that question at all because she probably perceived it as a joke. And so it was like, yeah, we can say words but like, oh, but if you're actually asking someone who you are in love with would be heartbroken and devastated if they broke up with you and you honestly do not know if they're gonna marry you, then you should probably re check your relationship. Because you probably should know when you ask someone, do you want to marry me? If you should probably be good guests. But let's back it up a little bit. If you're asking someone, do they want to be exclusive with you or like you think, maybe they cheated on you, but you're not sure if you're in a relationship at all in the first place. Like they're difficult things there because it's like, well, this person is important to me, but also maybe they aren't trustworthy, so I shouldn't care about them. And we get all wrapped up in these different issues and it really comes down to this idea of if I knew that this was definitely a problem, then I would confront them. I'm like, hey, you cheated on me. We agreed that that we were exclusive and you cheated on me and we're broken, we're done. You could confront them or you would take action on it, or if you knew for certain that you're like, oh, no, I'm just I just I'm jealous and I always think about these things and so I should just I shouldn't talk about it, but it's when we're stuck in the middle, they're like, is this something that I should say to this person like, hey, that was kind of racist of you to say like, oh no, they didn't mean it that way, I shouldn't say anything to them. Because then they get upset at me and accuse me of being, you know, rude or whatever. Like if you knew one way or the other, then you would feel less conflict and you would feel less stress. You would either say, oh, you're a hole FU and walk away and feel good about yourself and everybody would cheer you. Or he's like, oh crap, I'm the \*\*\*\* here. And not knowing leaves us in this middle ground where stress is. Maximum, because we don't know. Should I avoid this topic entirely with this person? Should I not ask my boss for a raise because I really am getting paid? You know what I'm worth right now. Or I should tell them like, you know, you need to pay me more because I'm worth way more than this. And ah, if you knew one way or the other, then you would know with clarity what to do. The question is, is there a third option? And this is what difficult conversations encourages us to do. Because most of the reasons why we get stuck is this blacker, white thinking. Either I am right 100% and you are wrong, or the opposite, and I need to figure out which. And the truth is, well, it's usually a little bit more complex than that. Also, when we're thinking about whether I should bring up a topic with a person or not, we're usually trying to figure out the perfect thing to say, like, but I want to figure out the perfect thing to say that's not going to upset you. I want to tell you like you keep leaving the dishes in the sink. I want to tell you that you're a dirty slob of a roommate, but I don't want you to get upset about it and I don't know how to do that and I'm stressed. So either I have to deal with all these dirty dishes or I have to deal with you getting all mad at me because you're a dirty slob. I don't know what to do. Well, there's a potential third option that involves theory of mind and asking questions. And when you're stuck and stressed about thinking about something like the dirty dishes for example, it's helpful to realize that it's generally not what you think it's about. Because difficult conversations, as we talked about last time are really three conversations at the same time. Or really all conversations are multiple conversations at the same time. It's just that when they become difficult, it's when these other things like emotions and identity matter more. So me saying, hey, you're a dirty slob, stop leaving the dishes in the sink. That's not just words that I am saying. They imply beliefs about what I think of you as a person and your value as a person. They are at how I feel about your dirty dishes in the sink. Not the dishes themselves but my feelings. But often we don't focus on those things, I'm just focus on the dishes. I'm not thinking about my feelings or my beliefs. This is just a funny video that encouraged you to watch if you have time. Because generally not the argument, whatever you think the argument is about. If that in fact was the argument was about, then it would be easy. But it's when you think the argument is about one thing and you're ignoring all of the things like the emotions and the beliefs that the argument is actually about. Then, yeah, no wonder is stressed because you're not actually talking about what you're actually talking about. So there's this what happened. Conversation. Did or did you not leave the dishes in the sink? We said we talked about it. And there's a dish. There's a dish. I see it. You're trying to play referee when, in fact the reason why you care that the dishes in the sink has something to do with your feelings and it has something to do with what this says about you as a person or the other person or your relationship. This dish is not just a dish. It means you don't care about me. Because we talked about this and you said you were going to do your dishes and you didn't. So you don't care about me. That means you're a bad friend. And I'm a good friend because a good friend cares about people, whereas the other person, they're like, well, you know what, a good friend, let's things slide. And so we have different, entirely different emotions. We can both agree, yeah, there's a dirty dish in the sink there. But how that makes each of us feel and what we then conclude that means about me as a person, about you as a person, can be entirely different. And this is very much related to the same model that's involved in cognitive behavioral therapy. That our emotions and our thoughts and our behaviors are all sort of related to these underlying beliefs that we have about ourselves and about other people. This brings me back to the main point that I was saying last time about communication isn't just about what you say, It is about what the other person hears and believes about what you say. And this is challenging because we see the world differently. We have different information because we have different experiences. We know ourselves better. It's much easier to know how you feel or think about something, you just feel it automatically. It's much harder to know how someone else thinks or feels about something. We have different interpretations of the exact same thing based on our previous experiences. I had a girlfriend who always criticized me for leaving my dirty dishes in the sink. And whenever I was like, yeah, but like you leave your used tips on the bathroom sink She was like, stop changing the subject. I'm going to use the other end later. Oh, yeah. Like you have a good reason. Maybe, but like, maybe you could stop being so critical of me. So that like, oh, in later relationships, if someone says, oh, hey, you left a dish out. You're not just reacting to that. You're oh my God, I've been yelled at before in my parents my whole life, whatever. Like, we have different experiences and different beliefs, and our conclusions that we draw about someone else's behavior often reflect self interests. Because, yeah, our brains trying to, you know, make us happy and make us, you know, rich or productive. And so if there's uncertainty, well, I'm just going to assume that it's the answer that makes it easier for me or better for me in some way. And communication is effective. Communication is really about when we're in sync with the other person when they're saying something and we understand to mean what they intend to mean. This study looked at what was happening when we try and communicate and see what's happening in the brain during an FMRI scanner. And they had someone tell a story. And they scanned the brain of the person telling the story and the person listening to the story. **When there is effective communication, when you understand what I intend you to understand, then there's actually a synchronization between our brains. That our brains are literally in sync with each other. But it's not like actually sort of in sync like a metronome. It's more like a dance. And that there are some regions in the listener that lag behind the speaker, like the insula for example.** Because like if I'm telling you a story about how I got punched in the stomach, I know I'm about to get punched in the stomach, but your insula can't react until I tell you I got punched in the stomach or the nucleus acumbens, like I know I can anticipate there's a joke coming or a twist, but you can't react to that until I actually say it. And it's the reverse where you're trying to anticipate what is going to happen next. You're trying to understand the motivations of the people in this story, but you can't understand those things until more information is coming. And crucially, the context that I'm sharing matters. Because I can tell you different pieces of information that change your entire perspective of a story. In this study, they took people and they played them the exact same story, but for one people they said, oh like there's this guy who thinks that his wife is cheating on him, but she's actually really faithful and he's just jealous. And they told the other group of people, oh, this guy thinks his wife is cheating on him, and he's right and she's just really good at hiding it, but he can't prove it. And they played in the exact same story of just an interaction between three people. This guy is wife and another guy. And what they found is that they had entirely different reactions to the story. Listening to the same exact story with a different context results in different patterns. In the default mode network, which is part of our theory of mind system, in our mirror neuron system, like when you feel empathy for who, when you think someone is lying, or what their motivation is completely different based on the context. This is really important when we're having difficult conversations. And it's really important because difficult conversations are the conversations we have about things that are important to us. We know that they are important to us because they elicit strong emotions. If they weren't important in any way, then they wouldn't create strong emotions. So it's just that when you have strong emotions about the thought of having a conversation with someone, it's just let you know, oh, there's something here that's important to me. It just might not be the thing that I'm focusing on like, oh, I'm focused on the dirty dish. Mm. It's probably not that it might be something else. Often it is your relationship with this other person that is the most important. And it's very easy to be aware of your own intentions and why you're saying what you're doing. It's much harder to be aware of the impact on other people, but they are much more aware of your impact on them and their own intentions. And this is one of the reasons why it's really challenging. I'll just sum up this slide next time, but in discussion section we'll talk a little bit more practically about what you can do with this information. But I hope reading the book gives you some practical tools for dealing with difficult conversations. Thank you.

Week 7 Lec 2 (Lec 14)

Okay, so welcome back. And I see a lot of people ticker Thanksgiving break early. So hopefully they're having fun. But we're going to have more fun in here, so jokes on them. We're going to wrap up a few of the last slides from last time, and then today we're going to focus the rest on technology and particularly social technology. Uh, I talked a lot about this idea of our theory of mind and what we are aware of about our own intentions. And what we're often not aware of is the impact on other other people. It's helpful also to realize that this is a complex thing because we're not also always aware of our own intentions. This is something that, that's covered in difficult conversations as well. Is that we look at ourselves through rose colored glasses. Like oh, I wasn't, I wasn't trying to make them feel that. I was just trying to, you know, be nice or something by telling them that I didn't like their haircut or whatever it was. It's very helpful to remember that different parts of your brain want different things. And your brain doesn't always tell you exactly why it is doing what it is doing. So that's why this process of having **effective communication** with other people is so complicated. Because the human brain is complicated. Even if it was just like we've been talking about for most of this quarter, just trying to figure out how to be more focused and productive and happy. And it's just you on your own. Well, you can't even figure out why you can't exercise more or go to sleep on time. You're trying to understand your own motivations. And it's actually a lot of the same tools, the same process of this reflective thinking, of utilizing your own theory of mind to try to understand yourself. So for example, you can see that you're sitting on the couch and not at the wooden center, exercising like you intended. Like, okay, that's what happened. Part of it like oh well I meant to do that, but here I am sitting on the couch. Why exactly you did that isn't always even obvious to you. And we can make assumptions about ourself that may or may not be true. Like oh, I'm lazy or I'm, you know, incompetent or I'm just overwhelmed or I'm too stressed or whatever. That's perfectly fine to create these stories that explain our own behaviors. But sometimes that doesn't, you know, that doesn't actually help us move forward or it's not a full and accurate description of all our behaviors. But the same process of utilizing theory of mind is something that you should use on yourself. And it's just that when we add somebody else into the mix who also isn't fully aware of their own intentions, it can get complicated. And particularly when we add this other facet of, oh, you are significantly more aware of the impact of other people on you than you are of your impact on other people. Just like, you know, if you accidentally stepped on someone's foot, they are much more likely to be aware of it because it, and it doesn't hurt you. So their brain is going to alert them, oh my God, something's wrong. And your brain might not alert you that you are stepping on someone's foot. And a lot of this stuff that we talked about earlier is becoming aware of yourself will help you with all of these interpersonal relationships. We could probably have a whole quarterlong class on just difficult conversations. Uh, but I think one of the main takeaways, whether you are dealing with yourself or other people, the simplest takeaway to help you have more productive conversations is to just assume that you're not 100% right about everything that's difficult. It's difficult because it feels so good to be right, release a lot of dopamine. It reduces stress to know it reduces Um, the activity in the interior singulate, which has to deal with competing ideas when things don't always make sense. We're like, well but I think I'm a good person. Oh, but this person is upset that I did that like that activates the interior singulate because it's trying to like something's wrong here and that's uncomfortable. It feels so good and clear. Just know exactly what is right and what is wrong and who is right and who is wrong and who is good and who is bad. And that just feels comforting and we fall into that pattern all the time. And I just want to let you know that if your goal is to be right, you can feel free to do that and you can pat yourself on the back about how right you are about everything, that's awesome. The one time that's a problem is if your goal is not simply to be right. If your goal is actually to help other people or to change the situation, like I can see that there's a terrible injustice going on. Well, okay, If my goal is just to be right and like I'm so right about how terrible this injustice is and you people are all wrong and terrible, like again, pat yourself on the back like you're right and you know it, that's awesome. But like, oh, is this helpful for me for other people to hear or does this just make me feel good to say? Because I feel good about myself and it just makes everything so clear. And all my friends are like, oh yeah, you get them. But this situation that I don't like, or these other people who are creating this problem, oh, they're not changing their behavior and that's where we get stuck, because we're like, but I feel so right and they're so wrong. So why should I engage with them? Why should I talk with them? And it's the answer is essentially like, well, sometimes what we wish for is to have that clarity of moral purpose. And we know we are right. And we just say exactly what we're right, and tell the other person how wrong they are. And they come to us like, oh my God, thank you so much for telling me how wrong I was like, you're so right, You're 100% right. I apologize. And I think we have this dream that a lot of times that will happen, but a lot of times it doesn't happen. And so we have this choice sometimes to get to either let go just a little bit of the fact that we're not 100% right about everything. That brings up a little discomfort. That brings up a little stress which pushes us back into our old habits of wanting to cling to what we are feeling right about. But again, experiencing discomfort, reason. Or you're not forcing yourself to experience this discomfort for no reason. Like, uh, uh, it's helpful to remember. Oh, right. My goal is to help the other person see things the way that I do. Like, if that's your goal, like if they saw things the way that you did, oh, then they would realize how wrong that they were. The problem is most people do not come to that realization by you simply telling them how wrong they are. In fact, that often leads them, that's stressful, to have someone you know accuse you and tell you how wrong you are. And so that just caused them to retreat into their old habits. And this is one of the reasons why, in our current political landscape, everyone believes themselves to be the morally virtuous side and to be 100% right about everything. And everyone can just sort of pat themselves on the back and demonize the other side. And that's wonderful, unless you're like, ah, but then you know, these people without power continue to not have power or you know, the injustice that I see continues to happen. Okay, Well then you are the only person who can decide to step outside of your automatic u of righteousness, which feels so good. Again, you can still be 95% right. But when you believe that you're 100% right about everything, then it eliminates your curiosity about, I wonder why those people think the way that they do. What exactly do we agree on? Like do we agree fundamentally about everything we do? We start, what do we actually agree on? I wonder why they think that way, or how they came to their conclusions. Often when we ask this. About other people and also about ourselves, like why is it that you think that way? Or how can you possibly believe that? It's not actually a question when we think of ourselves like why, why am I sitting on the couch? I told myself I was going to go to the gym. Why am I sitting on the couch? That even though it's phrased as a question, and these are the kinds of thoughts that we sometimes have, it's actually a question, it is a criticism. You're saying, I wonder why I'm not sitting on the couch. But there's an implicit answer to that, which is why you are frustrated and angry at yourself for sitting on the couch and not being at the wooden center. It is the emotions that create that question. The emotion is like, oh, I'm sitting on the couch because I'm lazy, that's why I'm not the wooden center. So we frame it in the question, but we have an implicit answer that implies a judgment as created by emotions. But oftentimes we can't even understand our own actions because we're stuck in this area of thinking about the what happened conversation. Well, a person who wasn't lazy would go work out. I didn't work out, therefore I must be lazy. And we're focused on what happened conversation as opposed to hm, I, How do I feel about this? The feelings conversation or the identity conversation? Like does the fact that I didn't feel like working out, does that mean that I am a lazy person? The identity conversation. Do people who work out like always feel like working out Like, do you know successful smart people ever, you know, doubt themselves? Like these are things that we can think about in a little bit more nuanced to stop judging ourselves. And we can use that same skill with other people. We say, how can you possibly think that? Why do you think that? Well, that is framed as a judgment. You're like, oh, you think that because you're a terrible person. So we are having an identity conversation. The other person is trying to defend their own identity. And so we talk about the things that happened, what you said, what I said, what happened in the world, whatever. We talk about those things, but we don't talk about the feelings that I have around those. The feelings that you have around those. What that says about me as a person, what that says about you as a person, No, those are the things that we just come to automatic judgments about, driven by habits in our wired into our stratum. And that just keeps us in the same pattern if you're perfectly happy with that pattern, as some people are. A lot of people in power perfectly happy. Oh great. Everyone else will just argue over things that don't matter. And then they get to say in power if you're like, oh, but that doesn't seem fair, I want things to change then you sometimes have to start simply with the assumption that you are not 100% right about everything and get curious about someone else's perspective. Even if you suspect that they are 100% wrong, you can't actually know until you try. I think that's actually probably a good summary of this whole course is just have that curiosity about yourself and about other people. And this is super important, not just in like political conversations, but in close relationships and friendships at work. Conflict is an inherent part of relationships. It is unreasonable to expect that somebody else will always understand exactly what you think and feel and always put that to front of mind. You could tell yourself, oh, but I always take into account other people's feelings. Okay, maybe you do a lot of times, but that is a self interested way of describing yourself. Which is perfectly fine to think of yourself as a good person, but it doesn't like you could care a lot about other people. But it is impossible to always be aware of other people's feelings more than your own, because your brain isn't literally connected to those other people's feelings in the same way. So we can attempt to account for our own perspective or to work around, or try to step outside our own perspective. But your brain is in your body, it is attached to your eyes. Therefore, it sees things like literally sees things from your perspective. It experiences, it has your sensations someone steps on. If someone steps on someone else's foot, it doesn't literally hurt in the same way you do not in order to be a caring, good person. To feel the pain of other people in the same way that you feel your own pain. You just need to realize like, oh, I have a perspective, everybody has a perspective. And once you can factor that into account, oh, the things that seem obvious to me or automatic to me, oh, that is my perspective. That is the way I'm experiencing the world. That's not wrong. It's not wrong that you're having the feelings and emotions that you are having or the experiences that you. But that is, those are your feelings. Okay. Are those skewing my perception of either what happened or are those skewing my perception of what the other person is feeling or skewing my perception of what the other person is saying to me. Because you have the ability to use your theory of mind to reflect on and understand yourself. And that I would say is the most valuable lesson from difficult conversations, is not actually to use it to have more difficult conversations with other people. It's to use it on this process, on yourself, to reflect on and understand your own automatic assumptions and identity. And that will, yes, that will help make it easier to have difficult conversations with people and make them less difficult and make them more productive. But it's if you just use that on yourself, it will oftentimes just make you feel better on your own, or it will obviate the need to even have this conversation with someone else. Like when my wife and I first started living together, I was really frustrated about how she loaded the dishwasher, and over time, I started to understand like, oh, right. So I kept trying to like bring it up to her and she kept saying, oh, yeah, sorry. Like, I'll change that. And I was like, oh no. It just makes it harder, you know, makes it harder to unload or the dishes don't get as clean or whatever. Over time, I started to realize like, oh, she's not loading the dishwasher her way because she's trying to upset me. Even though I've said it, I was like I already told her five times, how can she not change her behavior? Well, like because it doesn't matter to her. In the same way that it matters to me. And that opened up this conversation in my own head of like, oh, well, why does it matter to me? And I was like, oh, it matters to me because of some previous relationships I've had where, you know, partners didn't listen to me. Oh, and that goes back to, oh, probably like, because when I was a kid, I felt like when my brother and my sister complained, they got listened to more. Oh, so I have this problem with like when people aren't listening to me. I'm applying that. My brain is reacted in this automatic way to this specific situation. I realize like, oh, what makes this a good relationship is that if I could, I believe, clearly explain to her why this was so important to me and how it was impacting me, then I believe that she would probably change her behavior more. But I couldn't do that because it really is like, oh, it's not actually that important to me at all. The only reason why it's important to me is because it's triggering these other beliefs and automatic assumptions that I have. Like it's not actually important. And then my feelings about it just changed. I didn't actually need to continue having a conversation or to change her behavior. I just understood myself more and changed my own perspective and it literally cease to bother me or be a problem anymore. And a lot of times we get stuck in things because we are unhappy. We don't recognize that we have a perspective or experiences. And we think the only way to change my feelings is to change the other person's behavior. But if we engage in these processes, a lot of times we can see, oh, I don't actually need to change the other person's behavior, which is wonderful, 'cause I don't have control over the other person's behavior. And sometimes if I can do this successfully in my head, it just, oh, the feelings go away. Which is very different than ignoring or suppressing the feelings. Just, they're just not there anymore. And a lot of us have a hard time, I think, understanding when is it that I've oh, truly accepted something and the emotion has gone away, versus am I just telling myself I've accepted something and the emotion is still there? How do you know that? Well, if the situation happens again, or somebody accuses you of that, and it creates all those strong feelings. Well then, yeah, they're still there. You're just ignoring them. Like I used to do stand up comedy, I realized that part of the reason I was doing stand up comedy is because, I mean, I liked it and it was fun and it was a good challenge. And, you know, I got good positive feedback. But I realized like part of my motivation was because my girlfriend in high school had been telling me about how funny her ex boyfriend was. And I was like, he was like older. She was a little older than me and he was even older than her. And so I was like insecure. And I was like, oh, but like, you think I'm funny too, right? She was like, yeah, I mean like, you're funny but you're not that funny. I realized like, oh, that got in deep somewhere in my beliefs about myself and my emotions. And so therefore, later on when I was performing stand up comedy, part of it was like I'm going to prove to her that I am funny, but that doesn't necessarily lead to enjoyment of what you're doing. It doesn't lead to fulfillment. And so when I was like, huh, why is this not as fun as it used to be? And I was like, oh, because part of my motivation for doing this isn't just to have fun, it's to prove her wrong. That's when I realized like, oh, I've convinced myself that I'm funny, I knew because I'd performed in front of, you know, 600 people and made them laugh. I had performed in front of six people and made them laugh, which is way harder. And I realized like, oh, if someone told me that I'm not funny, or someone said, I don't think you're funny, I wouldn't care. I literally don't care. Not because I don't want to make other people laugh, or because I don't want to be funny. It was just a recognition of like, oh, well I know that I'm funny. I know a lot of people think I'm funny. And just because someone is very funny doesn't mean that other people will laugh all the time. Or that you can make everyone laugh. Or that everyone, even if someone who generally thinks you're funny, they might not think that joke is funny. And so it just went away. Like if someone didn't think I was funny, like I didn't care anymore. And this is just a powerful tool that you can use on yourself. Because when other people accuse us of things or talk about things, they make us uncomfortable. We often believe those things or they only affect us or have strong emotions because they're wired in our beliefs or habits, in the way that we think about ourselves. And those are things you should often revisit. If you avoid thinking about these things, then we'll often have an impact on your relationships and your life satisfaction. This particular study looked at predictors of divorce and certain kinds of behaviors that people engaged in that predicted whether they would get divorced or not. They brought couples into the lab, had them talk about an argument, something that they would usually argue over, and they filmed it. And then five years later, like checked back in, like, are these couples still together? Are they divorced? And they found that these four factors were the biggest predictors of which couples got divorced five years later. Contempt, I think is one of the most problematic. Criticism is like, oh, you criticize the other person, you always bring that up, you know, blah, blah. I stopped talking about the dishwasher and I said, oh, because you're so critical, you're such a mean person whatever, you start criticizing the other person or you just get defensive and just defending your own behavior, which is totally understandable when you feel attacked. But to feel attacked, you have to believe the other person is attacking you. Not that, hey, we're working together to solve this problem or stonewalling is just like, fine, fine, fine, you're right, you know, whatever, whatever, it doesn't matter. Well, that's not helpful either to actually move forward together because like, well, is it a problem? Well, they're just pretending like it's a problem, or just saying you don't want to talk about it. That's not generally helpful. But contempt is one of the most problematic. Because contempt is sort of related to this concept that I was talking about earlier, of believing that you are morally superior, that you are 100% right about everything, and that makes you a better person than whoever you're talking to. And if that's in a regular conversation or with a friend, that is very problematic. And it's particularly problematic in a close romantic relationship. If you have this belief that you are morally superior, well, it's probably not going to be a good relationship in the long term. So hopefully you got a chance to talk about this in discussion section, but I would say. This is all in the book as well. But I would say, yeah, if you just start with the assumption you're not 100% right about everything, That helps a lot. Sometimes people have told me that they were frustrated that there are only four chapters of the book assigned. Because like, oh, it's so fascinating has really helped me understand these difficult conversations. But I wanted to read more to find out like how do I implement these things and put them into practice? That reminds me of time when I was in college where I guess I just graduated. I remember recognizing that I had never read Hamlet, and I was like, It's crazy. It's one of the most famous plays of all time. Like, I've taken a lot of English classes. I took two years of AP English. We read Romeo and Juliet and read Macbeth. Haven't read all this stuff. I've never read Hamlet, and it's crazy. I've gone through all this education. I haven't read Hamlet and now I'm never going to read Hamlet. Because the only time you read Shakespeare obviously is like someone forces you to read it. And I was just like, kind of disappointed. I was like, oh, it seems like my education was incomplete. And then they had this thought, oh, I guess I could just read it, Which seemed absurd because through most of your education, you only read things. Like you either read things because you really want to read them and you're excited and they're fun, and your friends are talking about them, or you read them because they're assigned to you. And it was this light bow moment where I was like, oh, I could just read something just because I want to, even though I don't, I'm not super excited about it. That's what I would encourage you to do. And by the way, I read Hamlet, it was amazing. It was my favorite Shakespeare play, probably because it's the only one that I wasn't assigned to read. But like, it's very insightful and enjoyable to read and has amazing lines from it. So that's what I would invite you to shift your thinking about. It's very hard when you're in college and you have a ton of assigned reading, but if this interests you, well, then you could just read the rests on your own. Uh, so that, that brings us to today's specific topic, which is about technology and specifically social technology. We've had a lot of advances in technology over the years, particularly in the last 100 years. Technology is such a part of our lives that sometimes it's easy to take for granted. But it's helpful to just like, you know, compare your life and your use of technology and reliance technology to how things were 100 years ago. There have been huge advances in health. That's why our life expectancy is so much longer. Or diseases that just used to kill people like oh now. Or easily treated like antibiotics like people just used to. Oh, you got a tooth infection? Ooh, it's spread. Oh, you died now. Dental care is better. So you probably don't get a tooth infection in the first place, or if you do, you just take antibiotics. Travel has improved a lot. I remember my wife telling me her grandmother like took a boat to Europe and it took like two weeks. And now if you wanted to, you could just fly there in a matter of hours. And, you know, you used to have to mail a letter. And that letter would have to go on a train and then go on a boat. And then, you know, take a long time, take weeks to get somewhere. And now you can just face time, someone like literally almost anywhere in the world. You could have a zoom conversation with like ten people on five different continents at the exact same time. So our advances in technology have improved things at. But part of the problem that comes with that is that our expectations of what technology is capable of or should be capable of has outpaced our actual technological development. That creates a problem. If you think back to that, the lecture we had about dopamine and expectations, and when you expect to win money and then you don't have the biggest impact. Say let's look at health care. We've eradicated some diseases. We've treated these things that used to be fatal, but we're still mortal. I think in the olden days, if someone got sick and died, it was easier to accept. You're like, well, yeah, what? Like, you know, we can't stop death. Or if you got sick and then you recovered, you're like, oh, thank goodness, like I could have died. My cousin just got the same thing and they died from it. And here I am, I got the flu and, you know, several hundred thousand people died. And I'm like, oh, I'm so grateful. All I did was get sick for two weeks. Now if you get the flu, you're like, oh, kidding me. Like now I have to miss my classes. Like why haven't we figured out the flu? Why haven't we gotten rid of the flu yet? Or like you have a bad cold and oh, you don't get to go to the, you know, Taylor Swift concert with your friends like, oh, my life is ruined. Because it does seem kind of insane. Like how we treated all these diseases. We haven't even gotten rid of the cold or covid like we had to, you know, shelter in place. And it's amazingly remarkable how fast the vaccine was able to be created. Considering for all of human history, people just started, had to get sick and die. Our vaccines took decades to be developed, and yet we were like, yeah, but it doesn't work as well as it should. Oh, it doesn't work against all of the strains like, oh, it's kind of painful. Oh, it's annoying. And so we focus on a lot of the, the drawbacks of the technology that we haven't yet developed because our capacity to imagine those things has advanced further than our actual technology. That doesn't mean that technology isn't actually benefiting our lives, but we often take it for granted and don't realize or recognize how much it is. Technology can also have impacts that are both positive and negative, and that it can be exciting for things to come out. The new iphone are like, oh, electric cars, they are going to have better batteries. And so I can drive further. Like that's exciting, but it can also be stressful because now we have to get used to different things. Or I got used to the way this thing worked and now it's going to be new. That problem will only get worse for you as you get older. You're young, your brains are still really plastic. You, there probably hasn't been many technologies that have been around your whole life. So they're constantly changing, so you have no expectation that they should stay the same. But, you know, as you get older you'll get used to things and you'll have more habits around things, and your brain will have less of an ability to change. And you'd be like, oh my goodness is so annoying. Or I don't even know if I'm going to be able to figure this new thing out. So that can be you've probably experienced this in small ways where you get used to the remote control or the menu for your TV. And then for some bizarre reason, the cable company just changes it and you're like, what? Now I can't find the channel that I was looking for. Or like you moved to a new apartment and it has a different remote control and you can't figure something out for, you know, a week until it becomes automatic or like the advance of AI. You're like, oh, I know you had a job that you thought you were going to do. Now you're worried and stressed out like, oh, maybe AI is going to make that irrelevant uncertainty. That stress is caused by uncertainty with potential big consequences. Technology can sometimes create excitement and cause emotion because there's uncertainty. If we focus on the positive upside of that, then it's exciting. If we focus on the negative and how that might impact our ability to have a job, well then it's stressful. But the point is that technology can impact a lot of these things. One of the ways that technology is impact us is through the dopamine system. I'm just going to revisit briefly some of the things that we've talked about the dopamine system and connect them to technology. So we know that dopamine is released by novelty or new things, so that's one of the reasons why new technology is exciting. It's just new iphone 15. How is it different from the iphone nine? I don't know, like oh it's got this little thing, whatever. It's just new companies know that you like new things and so they release new things even if they're not really that different. Dopamine is released by surprises. And this is why video games are sometimes addictive because, yeah, you have the basics of the video game, they're doing it then every once in a while, oh, there'll be a surprise box what's in there. And that gives a little boost of dopamine. Is that good or bad? Well, it's one of the things that makes it more enjoyable, but also it can potentially, maybe be addictive. And get in the way of other things that are enjoyable, like social media companies understand this. And so like, oh, well let me just show you thing you're scrolling through. Oh, let me just pop up. Oh, here's a new thing. Here's a new thing. Oh, here's something that's exciting and that Yes, it's one of the reasons why, you know, Tiktok and Instagram, like they're fun and exciting to use and yet they're engineered and designed so that you use them more because that benefits the company. This is not saying that this is al problematic, like you still get to enjoy them, but if a technology is designed by a company to get your brain to accomplish their goals, then there might be times where your individual goals diverge from the goals of the company. And that's where it's just helpful to understand, oh, this effect that the technology is having on you, not because you can't use the technology. Oh, but if it was just a hammer. Oh, well, if this hammer only worked on, you know, one brand of nails like oh, well there's hammers like, it's helpful to recognize that tools make certain things easier and make certain things harder. It's helpful to be aware of that effect is having on you. Dopamine is also released by accomplishing goals or moving towards goals. When you make clear progress towards a goal, you release a little bit of dopamine that pushes you to try and finish that goal. That's an awesome feature that our brain has where if you write the first page of your ten page paper that release a little dopamine and then you write the second page, oh, releases more dopamine. It makes you more excited to finish that paper. Technology companies understand this too, which is why like you start filling out a form and they're like awesome. You're 25% of the way like oh, you might not even want to fill out this form, but there's a part of your brain, the nuclear of commons, the dopamine circuit, that's like, oh, I'm almost there. And it releases domain to get you to want to complete that goal. If that goal is misaligned with the other things that you're like, oh no, I really wanted to write my paper. Then you have this conflict. And it is helpful to be aware of the influence of that technology on your brain. This can become a bigger issue even with things like addiction. This study that people who are addicted to their smartphones, which this study was done ten years ago. So probably now qualifies as everyone basically. But smartphone addicts have reduced impulse control. How do you know if you're addicted to your smartphone? Well, how did you feel if you accidentally left it at home or if someone took it from you, Like, oh, it's uncomfortable. And so we carried it around as a safety blanket. And you know how much anxiety you would feel without your smartphone. Well, we all probably feel some level, but whether it's, it would be problematic or not, uh, is probably different if it would be sort of intrusive and get in the way of other important things to you. Well, then you might have an unhealthy relationship with it. But people who had smartphone addictions also had reduced gray matter and parts of the anterior cingulate and the prefrontal cortex. One explanation of that is like, oh great, this addiction is damaging their brains, damaging your ability to pay attention and be present. It's damaging their ability to say, medial prefontal cortex, their theory of mind system or the dorslateral preferential cortex, their ability to cognitively reappraise things. But you could also interpret that as like, oh, well, maybe these people had reduced gray matter in these areas in the first place, and that's why they fell into this smartphone addiction. I had talked about this specific study before. Just put in the context of technology that online gaming addicts have reduced gray matter in the orbital frontal cortex is key motivation part of the prefrontal cortex and reduce insula gray, this part that's so important in recognizing and understanding our own emotions. Now I just want to talk for a moment about multitasking, which is something that technology can facilitate. Because one of my, I think main takeaways about technology is it's useful to think, remember that technology is a tool, but what makes a tool helpful or useful is what it helps you accomplish. Is a hammer a useful tool? Yeah, for hitting nails. It's not helpful for like painting or like. If you're using the hammer, will it sometimes hit your finger and really hurt like, Yes. Does that make it not a useful tool? Well, like there's ways to use it wrong. Could you use it as a weapon? Like could you use it to accidentally hurt yourself? Yes, but like technology makes certain things easier. If they're good things then we would call it a good technology. And if they're bad things then we would call it, you know, a problematic technology. But they will always make certain things easier and certain things harder, like using a hammer makes it easier to hammering a nail. It makes it harder to keep your thumbs safe. Does it have a good balance between those And you're like, oh yeah, that's a good technology but all technologies make certain things easier. It makes certain things had less obvious. And to use that technology effectively, you should become aware of what is facilitating what it is making more difficult. Technology has made multitasking much easier. Is that a good thing? Well, you probably think of multitasking as doing two things at once. But if those two things both require your attention or cognitive processing, then you can't actually do two things at once. You can do two things at once if one does not require cognitive processing. Like you can walk and chew bubble gum, you can listen to music while you are writing a paper. Those can actually be helpful sometimes, but you can't analyze a piece of music while you're writing a paper because both require the same analytical parts of the brain. When we are doing two tasks that are cognitively demanding, you might think you're multitasking and doing two things at the same time. But what you're actually doing is switching back and forth between them. Like this is one of the reasons why texting and driving is problematic. Because you can't pay attention to your phone and the car in front of you at the same time. You can go back and forth but you can't actually do them at the same time. This particular study want to look at how that would affect our performance because we don't always realize that impact on us. So they had people do Sudoku and this word search, just basically two tasks that both required your cognitive processing. They had people do one and then the other. I'll show the results of the study in a moment. But what I wanted to point out is this issue before that, when you switch back and forth, it's not seamless. Your prefrontal cortex is used to do some thinking about this specific task you're doing. But in order to try and figure out like, well, should I switch tasks right now? And like once I've switched tasks, okay, and now I have to remember like, what is it that I'm trying to do and reorient that also requires prefrontal resources. And so as a result, multitasking undermines your productivity because these prefrontal resources that could be utilized for doing the task are now being utilized for switching back and forth between tasks. If you're into computers at all, like your processor, if you have a lot of applications open, like I do, your processor can't process many applications at once unless it's multi threaded, whatever. It doesn't matter if it has multiple applications open at the same time. What it has to do is switch back and forth, and that slows things down, rather than just doing one process for a long time and then another. This was shown in this particular study where they had people divided into three groups around. You were given 10 minutes to do the, so 10 minutes to do the word search you just did. And then one you just single task. 21 of the groups the same single tasking again. Another group did multitasking, which they defined as they would just have them switch back and forth between the two tasks every 2 minutes. Then the third group is given a choice, which I think is what we would more think of as common way of multitasking is like right here are the two things you have to do. You have 20 minutes, do them, You can switch back and forth whenever you want. What they found is that if we look at the combined men and women, well, the difference between round one and round two, this was the group that just did single focus the whole time. They actually improved. They got 185 points in round one and then two they did a little bit better, They got 190 points. I don't know, this must be a rounding error. I just noticed that I was like 80. That's not quite right. Anyway, so group two. This is the one they said, okay, well we're going to tell you when to switch back and forth. That group, way worse, as did the group that could just switch back and forth whenever they feel like it. So if these people knew that about themselves, like oh, whenever I switch back and forth, I do worse. Well then the group that had the choice, what they should have done was like now I know I have the choice to switch back and forth, but I'm not going to go to stick with one and then the other. And then they probably would have done better. But we don't do that because we are often unaware of the deficits that it has to us. This is why we might be tempted to text and drive because we are not aware of our deficit in driving while we are texting. Similar like one of the problems with drinking and driving is not that you are so much worse at driving after you've had a drink, it is that you are worse and you don't even know that you're worse. Your ability to tell how impaired you are is itself impaired. And multitasking undermines productivity, but not your awareness of your productivity. In some ways, you may even feel more productive because you have more dopamine. Every time you switch back and forth between these two tasks, you just get a little bit of novelty burst of dopamine. And that makes you want to switch back and forth, which further undermines your productivity. So you will feel perhaps more productive sometimes because he's like, oh my God, so much stuff was happening, but you didn't actually accomplish as much as you wanted. Some people, I think you've heard or said that like, oh, women are better at multitasking than men. What this study shows is like, well, everyone is worse at multitasking and switching back and forth. It's just that at least in this group, say in the one where they were forced to switch back and forth, the women's group did slightly worse. So that wasn't necessarily significant, but when they were given the choice to switch back and forth, well, the women were impacted negatively, just not quite as much as the men. So maybe it's possible, on average, women are better at multitasking than men. But that does not mean that they should multitask either, just means they are less impaired by it. This suggests that you should just do one thing at a time. This other study wanted to look at like, okay, one thing at a time helps your productivity. How does that relate to our happiness and well being, which is the other focus of this class. In this study, they looked at the variety of tasks that you were doing over a certain time period and how that related to your level of happiness. What they found is that if you did a low variety of tasks, that means you were just focused on one thing for a long time as opposed to switching back and forth. That would be a high variety. Well, the people who did a low variety of tasks, like just focused on one thing at a time for 10 minutes or 30 minutes or an hour, they were happier than the group that focused on multiple things. So not only did they, were they more productive, as evidenced by the previous study, they were also happier. But this is a complex relationship when we zoom out to longer time periods. Because what they found is that, well, if you look at the timescale of a day or a week or a month, then that relationship Switches that if you have a low variety of tasks over say, the course of a day or a week, like you're just doing the same thing for a whole day or the same thing for a whole week. Well, you're less happy than someone who's doing a variety of tasks. What this data suggests is that the best way to be happy and productive is when you are doing something, Focus on just doing that a decent chunk of time. Like you could break that into smaller chunks where like I'm focusing on 25 minutes and they take a break and then you relax and then focus for another 25 minutes or whatever. But like the general focus of what you're trying to accomplish shouldn't switch that much over the course of an hour. But over the course of a day, it's good to have a variety of tasks. And I see one of the problems that students run into when trying to study, for example, is they'll be like, I'm going to study for 10 hours on Saturday. They don't actually do that because they're constantly multitasking. And so they're undermining their productivity, but also like they're undermining their motivation and mood. Because it's boring to just focus on one thing, and you would actually be better off to say, hey, you know what, I'm going to focus for 2 hours and then take a break and have a good lunch and hang out with my friends. And then I'm going to focus for like three more hours and then I'm going to go have fun and not worry about it. And what that is is like fully focused your intention and efforts on just this one thing for a shorter period of time. And then fully focused on your other needs of like, oh, sociability and relaxation and enjoying your life, which will help you focus more on your tests. But a lot of times we get stuck in this pattern where we are like half fast studying. Because we're like, well, I know I'm going to be doing this for 10 hours, so let me just check my e mail and whatever. And then like we don't fully invest in that and so we don't produce as much and we're not as satisfied. And then when we're hanging out with our friends, we feel guilty because we're like, didn't really get as much done as I wanted to. So we half as steady and half as relax and neither is really satisfying. So we do need a variety of tasks. Just when you're doing something, just do that and when you're hanging out with your friends, like just do that. Don't distract yourself were like, oh but I should be doing this other stuff. Technology can have an impact on our physical lives. Like the more that you know, you can just do your work in front of a computer or work from home and you never have to leave the house. That might lead to reduced exercise or increased pain as you're staring at a computer or an increased neck pain because you're holding your body rigid. Or carpal tunnel syndrome because your body didn't evolve to sit in front of a computer. That's not how, that's not the main effect that a lot of our technology was designed for. But hm. Any technology makes certain things easier and it makes certain things harder, so it makes it easier to just sit and focus. That might create problems for you. Technology can also create sleep problems for a variety of reasons. One, just because of the light, like okay, technology is emitting light and that can disrupt your circadian rhythms in the way that, you know, in the olden days, you know, candle light didn't disrupt our circadian rhythms as much. But also on a different level as well. Like it used to be that people went into like an office to do work. And when you went home, like you couldn't do work because your work wasn't there. And then we had computers and people are like, oh great, I can still do work at home. Awesome. But now, like you can do your work on your laptop. Like 30 years ago, there weren't really laptops that people could use easily. And now you could bring your laptop into your bed, or you could just bring your phone. You could do a ton of work just from your phone. And it is so easy to use anywhere that you could use it in your bed, which is terrible for your sleep hygiene. So yeah, it makes it easier to be more efficient, get more work done, but it makes it harder to say, get a good night's sleep. Sometimes though, as I said, technology itself, it is the problem. It's how we use it and what it facilitates. So we can use technology to improve exercise, to track our exercise, and to track if we're doing our exercise the way that we want to be doing our exercise is good or bad. Well, we can use technology to have a positive impact on our exercise routines. One study found that if you gave pedometers to people just like a fit bit that counted your steps, they increase their total number of steps when you just encourage them to look at it. Because before you just walk around, you have no idea how much you walked. But now you have this number and you're like, oh, I walked 4,000 steps today. Oh, let me try and see if I can get more. Well, now you have a specific goal and a specific number that releases dopamine. And if tomorrow you walk 5,000 steps, you're like, oh, I did a good job, you release more dopamine. So that can help you take more steps. Particularly if you have a goal, like I want to walk 5,000 steps today or 10,000 steps today. There's not really a magic number that's perfect for everyone. Sure, 10,000 sounds good. It's not problematic, but there's nothing magical about the number 10,000 but it is helpful. Well, if I have a specific goal, well, the technology facilitates me achieving that goal, because technology helps me release more dopamine to achieve that goal. That is just one example of this broader idea of gameification, where we can the things that video game designers use to get us to accomplish a level or to keep playing. Or get us to do specific tasks in a game. Oh, well, we can sort of use those same things in real life to get ourselves to do things in real life. So an activity monitor is just sort of like one simple example. Like oh, I got 2000 points on my step monitor today. Oh, let me see if I can beat that. Oh, well the only way to beat that is to take more steps. I mean, you could tie it to your dog too, and that's cheating. But by keeping score makes it more fun and exciting sometimes to try and beat that. That's because of how the dopamine system works in nuclear succumbents. This isn't necessarily just modern technology. Just like even simple things like a heart rate monitor, like when you're at the gym and you're running hard and you're like, okay, well I want to get my heart rate up to 120 for 10 minutes. Well, if you're just running, it's like, oh, it's uncomfortable. It's difficult if you have a specific quantifiable goal. Sometimes it makes it easier. She's like, oh, it doesn't matter that I'm uncomfortable. I'm getting my heart rate up to where I want it to be. Also, ways that technology can make exercising more fun, like the fit is a perfect example. I know Microsoft has some as well or Pokemon Go. Its goal isn't explicitly to get you to exercise, but if there's a squirtle or whatever over in Kirkhoff, like why I got to go walk fit. The consequence of it is that you exercise more whether it's explicitly part of the game or implicit. This one a game called Extra Game, I think that was early Microsoft something game was used in elderly people to like get them to exercise more because it's not as fun to exercise when you don't have energy and it's not fun. But if people are like, hey, can you pick apples on this tree? Like, oh, I can do that. And they found that particularly in elderly adults, it reduce their levels of pain. It probably wasn't as effective in where's my mouse in middle aged or younger people. Because most of us, you know, walk more, good enough exercise. But like, yeah, if you're like stuck in a nursing home all day, it's just easier to like play this video game that causes you to move. Oh, it's not just fun. Oh, it also has these other positive benefits. And sleep monitoring can also be helpful because it can tell us information about like, oh, how did you actually sleep? So I could potentially improve my sleep. But as I said, technology in and of itself isn't good or bad. It is how you use it and what it facilitates and what it makes easier or harder. So sometimes sleep monitoring can cause problems because before you just, you know, you woke up and you're like, oh, I feel fine And then your iphone or whatever app you're using is like, oh, you didn't get enough rem sleep. You're like, oh my God, I didn't get enough sleep. What do I do? Well, you can't, you don't have direct control over how much rem, sleep you have. So now you become aware of this thing that you can't directly control and you're believing that it is causing problems in your life. So before you were just like, oh, I guess I didn't sleep that well. Okay, Let me remember to exercise now. You're like, oh, you can not necessarily well, but you can become hyper focused on it and people are like obsessing. Oh my God, today I got, you know, 5% less rem, sleep than I got the night before. And now it's just a new thing to worry about was before, you've just been like, oh well because sleep monitoring, this study found that increases awareness of sleep issues, but doesn't always help you address those sleep issues. And so it just can make us more anxious. This study, I love this, explains one of the things that I'm having you do all quarter one of the motivations behind it, which is the daily logging. It does help you understand whether specific interventions have a certain effect on it, is teaching you about the scientific process of gathering data and reflecting and making hypotheses. But what it is also secretly doing, independent of any of those goals, is it forces you or encourages you, I should say, to take a moment to think about, huh, I wonder how I am feeling, and then I'm going to write it down. You don't have to actually do that. You could just write down any number and not have that moment of self reflection. But that moment of self reflection is extremely powerful and technology can facilitate that. Even if it was, I'm going to write it down on a pen and piece of paper. Well, if it's a phone that you're always carrying around in your pocket and it's fun to use and whatever it can fact that moment of awareness. This particular study, the studied mood mapping app in young people. They found that using it, increased emotional self awareness. That is, these people all became more aware of their own emotions when they used it in people with high levels of depressive symptoms. They found that on average, it improved the depressive symptoms by virtue of increasing emotional self awareness. Just mapping their mood didn't have a direct impact on the depressive symptoms. But just keeping track of your mood increased your emotional self awareness. And having greater emotional self awareness then reduced depressive symptoms. But then on the flip side, well, not on the flip side yet. One of the advances of technology also is that it gives us more access to information and health knowledge that we didn't have before before. If you had some symptom like 30 years ago, you had to go to the Dr. and either it went away by the time you got to see the Dr. a week later it got worse and you were, oh, I'm so glad I went to see the Dr. But now you can Google that. Go on Web MD and find a lot of health information. You can even get therapy over the phone, over zoom. You don't even have to drive to see a therapist. Even more powerful than that perhaps, or more scalable I should say is internet based CBT, where a lot of CBT is. A lot of the stuff we've talked about in this class is just learning certain skills and awareness of your mindset. And you could just basically take a course on that or watch a Powerpoint. And you don't have to go talk to an expert about it. You can just do that in the comfort of your own home and learn a lot of these skills and insights. And so not only does that make it easier for you, it makes it way more cost effective because you know you don't have to have an expert. The problem with that Is that it's not always as effective as going to see a therapist. So if I sold you a hammer and I was like, hey, this hammer is only costs $0.02 and that other hammer is ten bucks, you'd be like, oh awesome. Well, but if this is like a rubber hammer and it doesn't actually hammer in things that you want, then like, right, It is a cheaper tool and it's an easier tool but it doesn't accomplish what you want it to accomplish, then it might be problematic. What they found is that yes, it's easier and cheaper to administer forms of cognitive behavioral therapy over the internet, just with a course, for example. It doesn't help people as much, primarily because most people don't finish it, because they don't have the support. They get bored or confused or they just forget. Therefore, it doesn't actually help them. This study found that if you just increase the level of support, then you can make Internet based CVT much more effective. And that doesn't mean that like, oh, you're going to see a therapist all the time Sometimes it's just like, oh, well you just have, you know, a trained professional but they didn't go to, you know, three extra years of therapy and train. They're just someone who's calling you on the phone, like hey, just check in. Did you start the program yet or like two weeks later like hey, just check in. How are things going? It's not therapy itself, but it is supporting you to go through that. And the more support you have, the more effective it can be. And that also makes it scalable and means more people have access both through making it easier and cheaper. But there is still an advantage of talking to an expert, whether there's a therapist or a Dr. because obviously that expertise does something, they've learned something that has nuanced understanding of your situation. Without them, we can sometimes get into trouble because we have access to all this information and think that we understand everything but you don't know what you don't know. And that has led to this term called cyberchondria, which is related to honor hypochondria, where you hypochondria is being preoccupied with your health and thinking, oh, this is a sore throat, is that a cold or is it the flu? Is it, is it covid, is it throat cancer like before, You just sort of had to be okay with not knowing because there's no way to find out. And you would go to the Dr. and the Dr. could professionally reassure you. Now you can investigate all of your fear fantasies as as you want and find out that whatever symptom you have somehow means you have cancer that can increase your health anxiety even if your health stays basically the same. This one study found that 10% of participants became frightened by the medically grave nature of information they encountered online. So that means you can get triggered, a downward spiral and worry and an for days or weeks until you can see a medical professional that you have some disorder. And then the Dr. can take one look at you or do a measurement like, oh no, you don't have that and you wouldn't have created that without this helpful technology. So it's just, again, useful to remember that technology makes certain things easier, it makes certain things harder. And there are many apps and tools that you can use. This is from a few years ago, but there are a ton available now. I consulted with this app most days, and so I went happy, not perfect. But yeah, it can meditation easier. It can make learning CBT easier. That's great to take advantage of. I like this quote from Plato from a couple thousand years ago that he said about the ipad because I think it was really prescient. He said, for this discovery of yours will create forgetfulness in learners souls because they will not use their memories. They will trust the external written characters and not remember of themselves. You give your disciples not truth but only the semblance of truth. They will be hearers of many things and will have learned nothing. They will appear to be omniscient and will generally know nothing. They will be tiresome company, having the show of wisdom without the reality. And I was like, that seems pretty accurate of having access the internet though he was talking about written language. Just like people aren't going to remember these epic poems anymore, they're gonna write them down. Obviously writing is a tool that we have used, has been extremely helpful. But again, it means that you're not memorizing stuff as much. Is that helpful? In a lot of cases, yes. Is there sometimes helpful to memorize stuff? Yes. Technology makes certain things easier. It makes certain things harder. When we talk about memory, by the way, this relates to a couple of different parts of the brain. Hippocampus is what we've talked about with long term memory. Remembering stuff that happened previously. Like you can't write down everything in your life, that would be a huge distraction and keep you from enjoying your life. The hippocampus is creating those memories for the long term. And this is distinct from something called working memory, which is your ability to keep information in mind long enough to do something with it. It's what helps you remember what I am saying at the beginning of the sentence So that by the time I get to the end of the sentence and finally complete my point that you know what to do with the information that I started talking about earlier. So if you don't have good working memory, you're probably like, what the heck is he talking about? Oh, right. He's talking about working memory. Right. Or if I tell you directions to go somewhere, I give you my phone number long enough for you to write it down. And that is something that is an active process in the Dorslateral prefrontal cortex. And so sometimes if we can just use external things like, oh, I'm just going to take pictures of my phone or I'm going to write something down, then we don't use these parts of the brain as much. And that can sometimes get in the way if they don't get exercised as much. Technology, um, can also impact our relationships for better or worse. While it's important to remember to be grateful for all of the wonderful things in your life and the things around you. There's something that's more important than things to keep in mind, which is other people you don't have a relationship with things in the same way that you do with other people. It, I mean, you might love your phone but it doesn't love you back. I mean, it might tell you if you ask, you could ask chat TPT do you know do you love me? Do you ask theory If you love me like it might tell you that, but it doesn't mean it in the same way as a person. Similarly, unlike with things, you don't have the power to affect their emotional experience of the world in the way that you have the ability to effect other people's emotional experience, whether for the better or worse. And that's crucially important to understand because our connection with other people is a crucial part of our well being. And I'll finish, finish these slides next time, but I think that's a great place to reminder for Thanksgiving that like yeah, this is opportunity to be thankful and grateful for the people we have in our lives. I'll just, you can read this poem on your own, but it's a wonderful reminder that we are all connected. We are all human and we're all on the same planet. And the more that you think of yourself as isolated and separate from the suffering of other people, then that doesn't necessarily make you feel better. So yeah, we'll talk a little bit more about the technology and its impacts on us, but use it for good, just like the force. And enjoy your Thanksgiving. Thank you.

Week 8 lec 1 (Lec 15)

Okay, so perfect. Okay, so yeah, so last time we were talking about technology and its impact on relationships. And I just pointed out that while it's great to remember to be grateful for technology or the things in our lives, we have a relationship with people that is different than our relationship with technology. And technology can facilitate our relationships with actual real people. And in that instance, great that technology is good and it is helpful. But sometimes technology can get in the way of forming actual real connections with people and then it's problematic. I'd say like one of the overall takeaways that I wanted you to get from the last lecture was that technology isn't inherently good or bad. Any particular technology will make certain things easier and certain things harder, or will get in the way of certain things. It's just that, okay, you should be aware of what effects it is having and use it for when it is beneficial to you. And if it's ever getting in the way, oh, to just notice that and find some other way to get what's important to you. So one small example is just how a cell phone can impact your relationships and your communication with people, and even your connection with them. I really like this study because of simplicity, but also because of this illustration. What the study was, they just brought two people in and had them talk to each other. They gave them a topic, either it was like a sort of a light topic, like talking about the weather or something, or it was a deeper topic about, you know, a childhood memory or something like that. So this is just illustrating that these two people were sitting chairs next to each other and there was a desk next to them. In the set up on that desk, there either was or was not a cell phone, a smartphone. So, I just like how, you know, they could just describe that, but they just want to show you like this is the technical, if you wanted to recreate the study, this is what it would look like, Judge, So there were two variables that they were looking at independently. One was the type of conversation they were having. Was it the light conversation or deep conversation? Did that impact how much closest they felt for each other or the level of trust that they felt? And then two, was there a cell phone there or not? The cell phone did not belong to either of the participants. It never rang. Nobody picked it up or used it. It was just sitting there. And they found that the mere presence of a cell phone just sitting on the table right there impacts the closeness that people felt towards each other, the amount of connection that they felt, and the quality of the conversation. So what this graph is showing is the presence or absence of the phone on the conversation type. Was it casual or about an important topic? And what you will see here on these graphs is that these graphs do not support the claim that I just made. Because, yeah, basically whether the phone is there or not, these people experience the same level of, say, trust in their partner. Or how they viewed the quality of the relationship or the empathy that they felt towards a partner. So why did I just say the opposite? That it did have a big impact? Well, because this is the data just for casual conversations. If you're just talking about the weather, doesn't matter if there's a cell phone there or not. But when you're talking about something that's important to you, like a childhood memory or what you're going to do after college or anything else, that's important, there is a huge Differential in each of these areas between when the cell phone is sitting there or not simply having the phone sitting there means that you trust the other person Less, if the phone wasn't there and you had a conversation, is a stranger you haven't met before. You have a conversation about a topic that's important, you would form a great deal of trust with them more than a casual conversation. But you undermine that ability when the cell phone is just sitting there. Or how much empathy you feel towards them. Again, uh, you would feel, you know, a reasonable amount of empathy towards them when it's just a casual conversation. And it could get a huge boost if you're talking about important topics. But you completely undermine that with the presence of a cell phone. And this is something that's really important to be aware of. Because sometimes we get in our own way of trying to form these close relationships, we know how important they are to us. We tell ourselves we really value these relationships. And yet maybe just we leave our phone sitting out, or we're just out of habit checking our phone. And I think part of the reason this has this impact is because we understand that when there is a phone present, we could get interrupted at any moment by literally anyone in the world. And if we're supposed to be having a close conversation, that requires some vulnerability. And that is why having a conversation about a topic that's important to us builds that closeness and trust. Because we have to be vulnerable. But if I'm telling you something about my dog died when I was 12 and it was terrible, and you just like glance at the phone like how does that make me feel? It's like, oh, here I am trying to open up to you and you just could be distracted by anyone else you're saying, oh, anyone else with any random problem in the world could potentially be more important than what you're telling me right here. So it makes it painful for me to feel, experience that sense of rejection. And also makes it harder for me to really open up because I'm afraid of that. So this is something this is, this is like a best case scenario where there's just no, the phone never rings, no one's actively trying to look at it doesn't belong to anyone. But in real life, we're probably making things even worse than this because you are actively looking at your phone and both people are doing it. And that is, that might not be a problem if we're just sticking to superficial topics. But if you just stick to superficial topics, then it's really hard to develop that closer sense of trust, and connection and empathy. And part of the reason why we do this is because I think of this cultural expectation that we have that we should always be available for anything and the technology that we have now facilitates that. It wasn't possible even, you know, 20 years ago you were on an airplane, sorry. Can't like literally, it doesn't matter what terrible other things happen to people. Like I'm on an airplane, I would love to be able to talk to you or support you. I'm on an airplane, I cannot. It is impossible. Uh And yet now you're like, oh, well, you just connect to the airport, you know the inflight, wi fi and you could talk to someone, you could text to someone, you don't have an excuse anymore why you can't be connected. And that comes with a lot of benefits that we get to be there for the important people in our lives. You know, your roommate calls you because they can't find, you know, where you put their phone charger or whatever. You're in the middle of a flight over the country and you can answer. Oh my God. Thank you. I'm so sorry. I put it in my desk or whatever. Like you can have real benefits. It can come from peace of mind or it can create peace of mind knowing that you're not missing anything important. And also just, you know, unexpected messages from some, you know, friend that you have. Those are exciting, they release dopamine. So it does come with a lot of benefits, this opportunity to be available all the time. But it also introduces this aspect of uncontrollability, an uncertainty because you never know when that your phone could ring and it could totally derail whatever you're trying to accomplish. Or just derail the mere act of being present and enjoying your time. And so these expectations of always being available create problems because we are expected to always be connected. And if you don't respond well, then you're doing something wrong. It can lead to unimportant interruptions because you're doing something that's really important to you. And then some spam, marketer calls you or a friend calls to just chat and like, oh, you do welcome that interruption. But maybe not right at this moment because you have a deadline in, you know, 45 minutes. You just got distracted and now you have to deal with them being like, well then why did you answer the phone if you couldn't talk? Or why did you ignore me, if you like? And it creates all these problems. And when we are in person and we are distracted by these technologies, it can signal to the people you're with that they're less important. And it might not be the signal that you're trying to communicate. But that is often what is communicated. As I said, communication about what is perceived or what is heard, not necessarily what you intended. So you're telling me about your dog and I'm like, oh, that's terrible. And I might just look at my phone for just a second just to make sure that nobody texted or whatever, but like that communicates the message. So like, oh, whatever random thought popped into my head that made me want to check my phone or whatever random person just happened to message me at that time is more important than what you are telling me. This technology of availability that facilitates our culture of availability also can lead to greater Fomo or fear of missing out because before we had all these technologies, maybe people were doing things without you, but you would have no way of knowing and they wouldn't really have a way of contacting you. And so there's a lot more plausible explanations. When your friends did fun things without you 'cause you're like, oh, well we called you at home, you weren't at home or like we sent you a letter two weeks ago and you didn't get it or whatever. Like people do fun things and you're like, oh, people do fun things without me, whatever. And now we're like, oh, nobody who I am close with should ever do anything fun without alerting me. And even if they like, hey, I called and left you a voicemail. You're like, who leaves voicemails anymore? You didn't send me a te, like it makes us more potentially makes us more anxious about that rejection of not being invited. But also we are more present to it because we see all of the fun things that our friends are potentially doing without us when they post about him on social media and they're like, oh my God, why didn't you tell me? And these were things that you just were blissfully unaware of before or didn't have anxiety about, but now the technology's improved, you do, and unfortunately the coping responses that we take, the ways that we deal with our fear of missing out, often reinforce that fear. Or rather reinforce that anxiety that our friends, other people that we care about, are doing fun stuff without us. Maybe it's just a anxiety, oh, that's so much fun, I would want to do that fun thing with them. Sometimes it's an anxiety about like, oh, am I not as important to them as I thought I was? Because they're having so much fun without me or they didn't invite me. But when we have these random thoughts that pop into her head like, oh my god, maybe all of my friends are off at a party and they didn't invite me. Those thoughts probably didn't occur to you as much when the technology wasn't available because like sure, like there's lots of stuff and you have no way of knowing or whatever. So the thoughts didn't even occur to you as much. But even if they did occur to you, they just sort of dissipated. Like oh maybe, oh, well I'll find out next week when I talk to them or whatever. Like there was no way to find out. And so there's nothing to do with that thought other than to just accept it. But now if you have that thought that pops into your head, you're like, oh, did everyone do something fun last week? And are they doing something tonight that I'm missing out on? Now you have a really simple way to reduce that anxiety, which is to look at your phone. You could check your E mail. You could go to your text messages. You could text a friend. You could see what they're posting about on social media. And it's still possible that they are doing stuff without your talking, you know, behind your back and making these great plans. But it increases our sense of perceived control. Oh, I had this fear. I took action by looking at my phone or texting someone or whatever. And that reduced my anxiety. And because it reduced my anxiety for that moment, it gets rewarded. And any time reward in action that helps reduce our anxiety becomes coated more strongly as a coping habit. And now, when we feel that anxiety, we feel even greater pressure to check our phone or text our friend, or seek that reassurance like, hey, are you sure you guys aren't doing anything fun without me? But that doesn't solve the inherent problem that, yeah, we always have this anxiety about our relationships because the relationship are important to us. But this coping mechanism can be an unhelpful thing that makes that anxiety worse. Just like if you're anxious, you have social anxiety and you drink a beer. Well, that helps you feel less social anxiety for that moment. It's just, ah, it doesn't solve the underlying problem and it can, can potentially cause further problems down the road. This also as it relates to sort of styles of attachment, like if you're texting your friends to just check in on them because you're worried they're doing something fun without you. Then they might perceive that you're being, you know, needy. You're clingy, which they don't like, and then they don't invite you as much. So we can by, these are some of the ways that the coping strategies we use to deal with our anxiety can increase our anxiety, but also make the actual thing that we are anxious about more likely to happen. Which is a downward spiral that there's no way to get out of other than to recognize that you are creating it. This brings to the question, is social media good for your mental health? And this is one of the interventions we had you do a couple weeks ago. You have your own answer, at least for this one little thing about whether it works for you in this one particular way. But the answer is that it's complicated because social media is just a tool. And it makes certain things easier and it makes other things harder or less likely. It was developed to help us connect more with people, and it can facilitate those interactions, but sometimes it gets in the way of actual connections with people. In this particular study, they texted people several times throughout the day to sort of get a sense of like what their daily emotional rhythms were like. And also they would ask them, have you used Facebook? This is back in 2013, so there weren't any other really popular social media platforms. They asked them about their mood and they would ask them about, have you used, you know, Facebook since the last time we text? And what they found, they studied people for a couple of weeks. They found that social media use predicted negative shifts of both feelings, your mood, that is, and life satisfaction. So they would text you and they would say, have you used Facebook? Or the next time they texted you, if you would use Facebook in between those two times? Well, if you use Facebook, it was more likely there'd be a negative shift in your mood and your life satisfaction. That is, the more people used social media at one time point, the worse they felt the next time they were text messaged. And this wasn't just on a short time scale of like a few hours, but also over that whole two week period, the more that they used Facebook, the more their life satisfaction levels declined over time. So that's weird because they go on its surface. Social media provides this invaluable resource that we desperately need to want to connect with other people that are important to us. But instead of enhancing well being, these findings suggest that social media may undermine it. This other study found that simply the amount of time that we spend on this social media, it is how exactly we are using it that can lead to these worse problems. They looked at whether people were using social media and its relationship to depressive symptoms. As mediated by the amount of social comparisons they made. So if you think back to our discussion about body image social comparisons, or just comparing yourself to someone else, and the more that you are comparing yourself to other people on social media, that had the biggest impact, the biggest increase in depressive symptoms. So if you weren't comparing yourself to other people and you were using social media, then you didn't see as big an increase in these depressive symptoms. So how we use it can sometimes create some more of these negative impact. Sort of like, you know how you swing a hammer. Well, a hammer is a really useful tool, but like if you use it carelessly or with the wrong sized nail, then you're much more likely to hit your thumb. So how you're using that tool can sometimes increase some of its negative impacts. And importantly, these social comparisons aren't simply what we normally think of at the problem being like, oh, you go on social media and you see all the amazing things that other people have, or the amazing vacations they have are how wonderful their life are. And we feel worse about our life in comparison. That at least I think makes more intuitive sense of why that's bad. But it's also problematic the other way, when you go on social media and you focus on how superior you are to all these other losers and idiots, you know, all your high school friends who didn't like Daniela. I'm so much better off. I'm at UCLA and there at wherever. That also does not make you feel better the more that you're comparing yourself to other people. Whether you come off better in that comparison or worse in that comparison, it is more likely to lead to a decrease in your mood or lower life satisfaction. So can social media be used for good? Well, the science point to yes, and there are definitely ways to benefit from it. This particular study compared three months of an internet support group with just an Internet based CBT self help program. They had four different groups. They had a control group who didn't really make any of these changes. They had a self help group that did this Internet um based self help program. So they were doing it on their own. They had people who had this online support group of others who were going through the same or similar challenges but without the self help program. And then they had people who engaged in both. And they all sorted of sort of at baseline, at the same levels. What is this? Immediately after the three months of the program, the self help group had improved a lot. The group that had just got the support without the self help didn't improve as much, but they improved in the group that got both improved. The interestingly, at six months and 12 months, the group that had the support group continued to improve while the group that did the self help, yeah, in the first few months they were doing this self help thing and they improved a lot. But then those improvements slowly started to go away over time. What they found is that online support is better than self help in the long term. Like in person support is probably even better. But sometimes it's hard to find other like minded people who are struggling in the same ways that you are. And so the Internet can facilitate reaching out and making groups with those kinds of people. This is one of the early things that was created on the Internet and the World Wide Web was just like chat rooms where you could go and you have a specific problem and you're connecting with other people. And you could find your group of millions and millions of people out there. You could find the people who were struggling in similar ways or whose viewpoint you wanted to hear from that. What this shows is like, yeah, just doing something on your own can sometimes give you a quick boost, but it doesn't actually have a long term effect. And so the best case scenario where you get a quick boost and a sustained effect was when you have both. So there are a lot of benefits to using social media, just not when you're using it to compare yourself. Which you might be doing automatically and without awareness, but if you Manage your profile to better reflect what the things are actually important to you. That is like, oh, I post pictures about things that are important to me. Or post about causes that are important to me that can actually improve your self esteem when you're talking and sharing about the things that are actually important to you. I like the title of this study, it's called, It's not that I don't have problems, I'm just not putting them on Facebook. And it's about the challenges and opportunities of using online social networks for health. That when we are in, say, private group, we're specifically talking to people who we feel compassion, empathy for. And we understand that they understand our situation. And it can be very freeing to post complaints or post about small achievements. Say if you have a specific health condition, it can be very freeing. Just like, oh, you know, I made this small accomplishment. And other people who are suffering through the same issue, they understand that and they can support you. And you don't have to worry about like, oh, are they going to judge me for, you know, showing off? Or are they going to think that my problems aren't that big? And so it can really help a lot. They found that selective sharing of information with supportive communities, like just okay, sharing, Sharing my problems or my struggles or my goals with the people who I'm actually close to, who I know will be supportive of me is incredibly beneficial for your well being. And so one of the ways I think we can think about social media is that it's just like a big party. And if you go to a real life party with some of your friends and you just start talking to random people and thinking to yourself, oh, these people are such losers. I don't want to be at this party or you're like, oh um, oh my God, these people are so amazing, I can never be like them. Well, you're not going to be thriving in that environment. However, if like you spend time with the people who you actually care about and use this party as an excuse to get closer together and form, strengthen those actual bonds, then yes, it can help and it can help immensely. So when you go to a party just or be on social media, like spend more time with the people who you are forming closer relationships with or who actually help you feel better about yourself. Like it's perfectly fine to follow people online who inspire you, who want to be a better version of yourself. That's fine, but you have to notice your own emotional experience, like, oh, am I just doing this social comparison? And this, you know, influence is just making me feel bad about myself and defeated. Like I could never be like them. Or are they like, oh no, I want to be like them and I believe that I can. Okay, great. Perfectly allowed to follow people who inspire you. And perfectly encouraged to connect and reach out and share with people who you feel close to or want to develop a deeper connection with. But this is where Doom scrolling becomes a problem. Because when you're just scrolling and not actually sharing, it's really easy to come from that judgmental viewpoint of just social comparison once you start sharing yourself and using that as an opportunity to actually connect with people who you want to connect with more than it has an incredible power to boost your well being. And uh, and so it's ultimately just a tool. But the problem with social media is that it is very easy to use in a way that is unhelpful to you. And the companies who are creating this technology will not necessarily make it easier to use in a way that is more constructive for you. Because their motive is like, well, they want to make it easier for you to use in a way that is more helpful for them. Which is to say, you know, market and whatever. So it's not saying that you can't use it in a way, it's just, oh, you should be aware of its effects on you. And use it in a way that is most beneficial to you. And that won't always come automatically, but it can happen with intention. And sometimes the answer is like right, don't use it at certain times of the day or don't have it on your phones because it's so easy to use mindlessly or just have some sort of structure around when or how you use it. Just like food, Food is good for us, right? But based on thousands of years of human evolution and cultural practices, oh, we've kind of arrived at some general guidelines. That are helpful to know like when is it good to eat food and what kinds of foods are good to eat that make you feel a certain way and when should you, you know, stop eating? And we just haven't developed as a society, those same concepts around like, oh, when is it generally good to use social media? Or how to use social media or, and what amount or with who. And that's why it's, it's much more of a challenge for you because just imagine how difficult it would be to figure out what food to eat if your parents had no idea how to teach you what food you would like or would be healthy for you. And so that's sort of the situation you're in, is created by our advances in technology. But this is just your opportunity to figure out what's the best way to use it for you. So now I just wanted to go into what today's lecture topic is about. I mean, it's all a part of productivity, well being. So it's all sort of one main topic. But today we're going to be more focused on the arts And the ability of creative expression and creative appreciation, artistic appreciation to influence our well being. And also talk about concepts of beauty and awe and wonder human. By the way, I suppose before I move on to, anyone have any questions or comments about social media, it's a big topic. I know these images are to illustrate the fact that humans have been making art for tens of thousands of years. So we've only had social media. That's a new technology. It's may be helpful, creates some problems. Art has been around for tens of thousands of years. The cave paintings in Lesco, France, for example, are 20,000 years old. There are ones that are even older than that. There are bone flutes. These bone flutes that were discovered are over 30,000 years old. One of the interesting things about these flutes and music in general, it undermines some of the potential explanations for these paintings. Because the paintings we could potentially interpret as like, oh, it's not the drawing a buffalo because they want more buffalo. Or what we can say that it just a more direct, concrete interpretation as opposed to artistic representation. A, I actually have been to some of these cave paintings and like, oh, you do get a sense like it's not like it does feel artistic, like there's some expression in it. Or you know, these hands like what do these hands represent? They're a little bit more abstract. It's not like I want to Buffalo. Is it a statement of just people acknowledging I was here? Is it a connection? Like, we don't know but it feels like it's something. And the flutes, the music complicates the picture. If you're just trying to say like, oh, it's just a concrete thing. There's no artistic element at all because the sounds produced by these flutes don't exist in the natural world abstractions. So they're also drilled at precise intervals. So they produce tones that are specific distances apart from each other. That is because the sound is just so abstract. It's harder to say like, oh, they're just trying to do this concrete thing. It illustrates that there's something about art that is a key part of being human. Where, what is the human condition? It's where these brains that are very emotional, they evolve to be really emotional. So we have these intense emotions. We have this really big analytical prefrontal cortex. And so we have the ability to understand and reflect on those emotions, as well as reflect on our current situation or to think about the potential things that could go wrong. Future. That's one of the reasons why it's harder to be human because like, oh, you understand that you're going to die and that all of the wonderful friends you have now, well, they might move to different parts of the country. And so it sometimes it's harder to just be present and enjoy the good things in your life right now. Because you know, oh, well, they're going to go away someday. Or things could be different. And art potentially helps us deal with those challenges and deal with this challenging brain that we have. It does in a ton of different scientific studies has been shown to benefit us in so many ways, both the expression of the arts, that is creating art or creating music, as well as the appreciation of the arts, which is listening to music, say or viewing art, or watching art. So there's a whole handful of studies. I'm not going to quiz you on the technical differences like, oh, that only comes from expression of art or appreciating art. But it's important to realize like art can affect us potentially differently in these two ways, whether we are just observing it or participating in it. Research has shown that artistic expression leads to reduced stress, improved mood, improved cognition, like your ability to think clearly and make decisions, as well as just greater enjoyment of your life, and enhanced empathy for other people. This is why it's such a shame that a lot of public schools, the arts, aren't valued highly. Because you're like, oh, we need to teach kids to read and at math. And a lot of research shows like we'll know being in music or painting, it doesn't directly get you to read better or get better at math, but it enhances your cognition overall. It helps your brain develop and it helps you regulate all of these emotional issues that would potentially get in the way of your further cognitive development. One study looked at stroke recovery patients who are in art therapy. And improved outcomes in depression, as well as their physical function and quality of life compared to just physical therapy. So you have someone who's had a stroke and they can't use their arm as well. Getting them to do art therapy not only makes them happier, it also improves their physical function more than just say, hey, let's just do more. Another hour of physical therapy in cancer patients. Creative art therapies, reduced anxiety, depression, and pain. There are some things that are best treated with a medication, like well, I want somebody to kill the cancer cells. That's an important part. I have cancer and I want to not have cancer like okay, there's certain medications that will help. But we don't want to stay alive just for the sake of staying alive. Like we want to enjoy that life and have connections and not have depression about the fact that we might die someday. And art can help deal with all of those complex things. Dance therapy can enhance empathy via the mere neuron system. Like the more you practice watching someone closely so you can imitate their dance. Like will you get better at developing your mirror neuron system, which is a key part of empathy? There are too many to go into detail here, but one that I wanted to highlight was that reading literary fiction can enhance your theory of mind. So I put this under the appreciation part where you're just, oh, you're just reading fiction, you're not writing fiction can have benefits, but sometimes reading fiction can be beneficial. I think this enhance this theory of mind because it helps you to experience more different people from you who are going through different situations than you've ever been in. And you can see based on what the author writes, like their own introspective dialogue. And so you can not only see the behaviors that they take, you can also understand why they did it. And this can enhance your ability in real life to relate to or understand other people. Um, and this other study, I think I'm going to talk about this more in a moment. But listening to music, say, when you're recovering from surgery, reduce stress and anxiety, and you know, you're sitting there recovering anyway. But sometimes just playing a little music in the background can improve your situation and that's very easy to do. So some of the interventions that we talk about like, oh yeah, they're really beneficial, but it takes a lot of effort. Exercise, like, okay, get exercises helpful for me, but like, you know, you have to go out of your house or it takes extra time and effort. Some of these things like listening to music like, oh, I'm already in pain, I can't do anything else like I'm just lying there. Okay, well, turning on to music can be helpful and that's what I wanted to focus on for the next few minutes is the benefits of music. And I used to, we used to have this, well, there still is group on campus called Mindful Music, which is started by this woman, Lita R. Kellan. And she doesn't work here anymore, but I was friends with her and I used to always invite her to this lecture, and she would like pull out a piano from back there. And we just like take a break and listen to music for 10 minutes. I unfortunately don't have a professional piano player, but I encourage you to. And we're not going to listen to this whole song, but I would encourage you to listen to it. Actually, I don't know, because this isn't hooked up to the sounds, But let me see if it will. Actually, no, it's not going to play whatever. She posted this video a few years ago of her playing Beethoven's Moonlight Sonata, and I really love that song, and I would encourage you to go listen to it when you get home. One of the interesting things is like I never really liked classical or romantic music. You know, old mics, hundreds of year olds with no words. It never really like connected with me. It just seemed like very abstract and not really related to anything that could help me or I appreciate. It seemed like this like cognitive exercise to understand, okay, I could do it, but it doesn't feel meaningful. And then in college, I took a class on the symphony as a music form, and it focused a lot on Beethoven. And I learned one that before Beethoven, like a lot of music, did have these sort of cognitive connections. It was much more thought of as mathematical expression like, particularly in Baroque music. They just did these cool patterns. It's like, oh, cool like mathematical expressions and it's interesting. And classical music evolved from that, became a little bit more complex. And that's where Mozart comes in. I'm not going to give you a whole musical history class, just a brief one, but one of the things that was fascinating about Beethoven is that, at least in Western music history search recognized that like, oh, these aren't just abstract sounds, like music can move us emotionally. Which people, you know, they did recognize that music moves you emotionally. But he was like, oh, but we can use that to express key emotions that maybe you couldn't describe or get at in some other way. And that was sort of the transition to the romantic period where he was like, oh, we can take all of this inner turmoil that you have and like you don't know how to get rid of it, but you could somehow turn that into music. And therefore, by expressing that emotion, not only get it out of, but to be able to connect with other people through that music. Beethoven had a fascinating life, and some of the reasons why I talk about this is just sometimes, if we understand a little bit more about a piece of art or piece of music, oh, it makes it easier to connect with because you're like, oh, it's not just some random thing. It's like, oh, this is created by a real person for a specific reason. Similarly, I think about like sports. Like if you just watch like some random sport that you've never seen before between two teams that you've never heard of before, you're like, okay, whatever, you don't care about it. But if you have, you know, a passionate fan or a good friend, he's like, oh my God, you got to understand the soap opera behind this. You say, oh, this guy, he was injured for three years and then oh, this guy, his dad was just, you know, kidnapped by guerrillas in Colombia. This is actually that's happened to a player on Liverpool a few weeks ago. But like, oh, if you understand like the actual human story behind these things, then all of a sudden, oh, maybe you can get into it a little bit more. And I know this is a bit sort of a tangent, but a lot of times, so sports are just sort of soap operas, socially acceptable soap operas for men to engage in and appreciate. But like we don't always, sometimes we need an entry point of interests to get into or to connect with a piece of music. And for me that was Beethoven. Because he not only is this amazing composer and very famous and it's time, but he's also start to lose his hearing slowly. Over the course of his adulthood, he lost his hearing completely, and he ended up writing these amazing symphonies, even when he was totally deaf. That I think is why the Moonlight Sonata struck me so much. If you listen to it, you'll probably be like, oh yeah, oh, I've heard that before. You've probably heard in a commercial or movie or something. But take 5 minutes and just sit there and just listen to it and try to be present. Not trying to understand it, but just experience it. And it's very hard to do because we particularly as goal oriented, intelligent people, I will put myself in that category too. Like we all have these, all these thoughts and we're trying to accomplish things and think and like that's wonderful to try and accomplish things. But if we can't ever just sit still and be present with our emotions, then that sometimes gets in the way of our ability to further accomplish things or to be satisfied. And the reason why this song, I think was so powerful is it's just, it's a very quiet sort of contemplative song. Which was time period in his life where he started to recognize that he was going deaf. And I can just picture him, you know, realizing he's going deaf. He's losing his hearing. He's losing this music that's so powerful and such an important part of his life. And he's lost his ability to appreciate it directly. And just seeing these like shafts of moonlight coming through the window at night and realizing, okay, it's a beautiful scene. But also like it expresses this interplay of like beauty mixed with like nostalgia for how he took all of this, you know, this beauty that he had access to through music for granted for so long. And how like, oh, maybe he could still appreciate it now, but also the frustration of losing it. And like you start to realize like, oh, there are certain feelings that we can have that are very complex. They're not summarized by just one word. It is very hard to actually express through language directly. It is very powerful sometimes to express things through language, and that's why we have artistic literature and poems. But sometimes the best way to describe it is through music. Sometimes the best way to describe this through visual parts. But it's taking this complex set of feelings you have and moving into the abstract realm that helps you feel alleviated of some of those problems. And part of that, I think is because other people can then listen to that music and experience and sort of understand, oh, this is, oh, that's what you were feeling. So I don't know what Beethoven was going through, but it is helpful like take a moment, think about how would you feel if something you had devoted your life to was slowly slipping away. And just listen for 5 minutes to the Moonlight Sonata. Here is the link for Delita's performance of it, but it's just a beautiful song and there are many ways and reasons why we respond to music. But I think this study I found really interesting because it showed has like a direct physiological impact on us. And we know from a lot of the stuff we've been talking about all this quarter, that our body's physiology is directly tied to the insula and the hypothalmus and our limbic system and Music has the ability to influence that. Excuse me. In this particular study they, they played people different kinds of classical Music And they found that uniform emphasis, reduced blood pressure. This uniform emphasis is just like, oh, like flowing music actually led to decreased blood pressure in Music If you heard this, you'd probably describe it as calming Music. Why do you describe it as calming Music? Because it has the effect of, and it actually impacts, your body's physiology. On the other hand, Music That had crescendos building volume, increased blood pressure. Blood pressure is just one marker of your autonomic nervous system function. When your sympathetic nervous system is activated, blood pressure goes up. When your parasympathetic nervous system is activated, your blood pressure goes down. This is just an illustration that Music has the ability to shift that balance one way or the other. In a lot of the most exciting and interesting music is one that plays with that. Sometimes music can just be like really loud and okay, it gets boring after a while. But this has the ability to impact our emotions by impacting our physiology. They correlations between not just blood pressure, but also other cardiovascular and respiratory signals. Particularly like your skin moving, like when you get goose bumps, when you are relaxing. The red expanding of your blood vessels which is what lowers blood pressure. It's just kind of cool like yeah. Music Has the ability to impact these sort of deep physiological things. Other research and probably your own personal experience shows that sometimes intensely pleasurable music can give you chills, like you're just listening to something and you're just vibing with it and it hits you in just the right way or whatever, and you get that tingle down your spine in this particular science that you've had personal experience, but these researchers wanted to see like, okay, but like what's actually happening in the brain when that happens? And they found that it's positively correlated with activity in the nucleus succumbins, which is not surprising. I was like, oh, this little boost of rewarding activity, pleasurable activity increases nucleus succumbin activity. It also was correlated with increased insula activity. Which again, is not surprising because like when you feel more emotions or music affects you viscerally, you feel more things. That also highlights another key aspect of why music can be so beneficial is that sometimes it allows us to change our feelings and we're in a bad mood. And oh, we just remember this song, we feel great, and then we are in a good mood. And so that's a powerful way of how music works. But sometimes music actually helps us feel our feelings better, that we are sad. And then we listen to sad music, and therefore, it allows us to experience that in a way that is cathartic. And then, okay, then we can let go of it and now move past it. Because sadness and anxiety and a lot of negative feelings are an inherent part of the human experience. And by listening to music, sometimes it helps us accept those or validate our own experience or even feel connected to other people. Because I'm not the only person who experiences this like other people have as well. And it makes us feel less lonely and weird. So that is reflected in our increased, you know, activity in the insula of our body's physiological and emotional reactions. Similarly with anterior singular cortex, that this is just, oh, like this is a moment that we should be present to and be paying attention to, and this is meaningful and relevant to our personal experience. But some of the other interesting things from the study I found really cool was that these chills that we experienced for music were also correlated negatively with activity in certain brain regions like the mid. It decreased amygdala reactivity. This again illustrates the power of music, is that sometimes we have to spend all our mental energy trying to calm ourselves down and regulate our amidlaa. We have to do all these coping habits or you just listen to music and the music can do that. For you and help calm you down. This is also related to, I think, why they found decreases in ventromedial prefrontal cortex activity. Because the ventromedial prefrontal cortex, its job is generally trying to regulate the Amigdla as part of this sort of self focused emotional part of the prefrontal cortex. It's job, It's like, oh, hey, mid, calm down. Trying to calm down them. If we get the music to do that for us, the ventromedial prefrontal cortex doesn't have to work so hard to make it happen. So it can just shut off for a moment and stop having to work so hard. These chills that we get are often a very pleasurable experience. This other group of researchers wanted to see like, well, how that must relate to endorphins, right? They found that when you get these chills, it activates the mid brain region called the periaqueductal gray. We've talked about this mid brain region that produces endorphins that gets activated when you listen to intensely pleasurable music. That's one sign that endorphins are involved because that's the brain region that produces them, gets activated. Another piece of evidence that points to endorphins is that if you give people a chemical that blocks opioids, and endorphins are of the class of opioids. Then it reduces the chills and excitement, exciting feelings that you get from Music So these are just two different pieces of evidence that show that endorphins are involved. It like, oh, it activates the brain stem region and if we block endorphins, well then you stop. Same wonderful feelings, lock one. By the way, I just put this into more context for you is essentially what is in the drug. Is anyone familiar with Narcan, or heard of Narcan is what you give someone a nasal boost of if they're overdosing on opioids. They've had an opioid addiction or whatever. They took too much opioids and they're opidosing. They're going to die if you give them this chemical. It doesn't really have many other effects other than, no, maybe just momentarily won't be as excited about. Music But it blocks opioids and can potentially save their life if someone isn't overdosing. It doesn't really have that many long term effects, but that's what this chemical Noloxone does. Yeah. Don't do it if you're trying to enjoy music, but do do it if you're overdosing or if you see someone actually just as a public service announcement, I believe. Like you can get trained in how to administer it and they have them available everywhere, You just carry it around and just be a hero potentially if you see some \*\*\*\* go down as an aside. Yeah, so I mentioned this study earlier, but Music also has the power to just relax us and reduce our stress levels and reduce our anxiety, not just like increase our joy and excitement. And this group of researchers wanted to look at how it could impact people recovering from surgery. And they found that it increased relaxation and reduced levels of cortisol, so it's reducing that stress hormone cortisol. They also found that it increased the neuroharmone, or neurochemical oxytocin, which we've talked about before. Like helps us feel more connected with people and usually is associated with, you know, physical touch or being close to someone. But calming music helps boost oxytocin as well and can make us feel potentially more connected with other people. We don't know from this like well, is the music reducing or cortisol directly, or is Music just boosting oxytocin? And oxytocin has these stress reducing effects. We don't really know. But it's very interesting that this is a powerful way to accomplish that. This brings me to the arts. Visual arts are sometimes hard to pinpoint about what makes something art or not. These researchers wanted to get at that aesthetic quality where you look at some image and you're like, oh, that's beautiful and another image that's boring or plain. So they just took some pictures. And made art. This is probably incredibly easy now with generative AI, but this is like ten years ago. And so they just took some plain images and made some artsy versions of those. And compared what is happening in the brain when we look at these sort of artistic representations or abstractions of just reality. And they found that aesthetic element of art selectively activates the nucleus incumbents, makes things more rewarding and enjoyable. As well as the orbitofrontal cortex, which is a key part of the prefrontal cortex for increasing our motivation. It's just illustrating that giving things the aesthetic element, it's sometimes hard to pin down but can boost the nucleus acumbents and orbitofrontal cortex. Question shall have photographs that are considered visual art. Right? So often, you know, if you go to our museum, we said they have photographs that are considered visual art. And they are probably very much like this guy. And this is why it's so important to realize like from any one scientific study you can learn very little. It's like because if you tried to study all complexity of the world, you can't. Science is about simplifying it to be able to understand something. So why art that looks like this might be meaningful or move you? It's probably just through a different mechanism or different reasons than the sort of the aesthetic beauty. And in fact, sometimes artists are trying to play with that. That you have an expectation that art is this way and oh, because your expectations are this, and it doesn't move you this way. It creates emotions. And artists aren't always trying to make those emotions positive or enjoyable. But it's just helpful to like this is one of the ways that art moves us and affects us. I talked about this study already. Both of these studies actually that just adding art therapy, well, it's going to improve your recovery from stroke. In a cancer study, in cancer patients, it might not change your cancer diagnosis or change your survival rate, but it can definitely improve your quality of life. And as long as you're like, well, I want to enjoy the life that I have these images. I'm just going to, I'll just show you. I don't need to talk over them. These again are just to understand, but just appreciate or notice your own reaction to them. Beautiful landscape. This is in Ireland. I believe I took this one. This was in South Africa. Oh, so this is also, you know, another beautiful landscape. But I know I was there. I'm not a good photographer. I'm not a good artist, like it doesn't quite capture the feeling of what it is. But photographers who are good at this oh, can capture the feeling of what it was like to be there. But all of those images are sort of meant to evoke some sense of awe. The natural scenes, often very expansive, create this feeling of awe, which is incredibly powerful and has many positive effects. One study compared awe inspiring images, sort of like the ones that I showed you, like expansive mountain vistas versus just mundane nature like a tree versus just neutral scenes that didn't have anything to do with nature. And they found that awe inspiring natural scenes improved mood significantly more. Uh, there was also an improvement in our sense of altruism and wanting to help or be generous to other people. There's something about awe and how it makes us feel small, it makes us feel more connected and wanting to help other people. They found boosts in immune function as well as parasympathetic activity, which are counter intuitive, but because often short term sympathetic activity boosts immune function, but chronic or prolonged. Sympathetic activity decreases and gets in the way every immune function, which is why you're stressed for a really long time, you can get sick. So awe, I think, can sometimes give us that calming moment of rest that might allow us to boost our immune function. But awe is interesting because it's not a simple emotion. It doesn't change our facial expressions in a clearly predictable way like most emotions do. And there are different types of awe, because it can be enjoyable, but also uncomfortable and overwhelming at the same time. Or even all of those. And it's both energizing and calming at the same time. There's research that shows that it impacts both our sympathetic and parasympathetic nervous system at the same time To create those sort of mixture of effects. When we experience awe, there's significant increases in a variety of brain regions. One, the stratum, like it pushes us into activate our habits because it has these powerful feelings that our stratum tries to activate, to try and deal with. But they're also the hippocampus, which is like, all right, like we should remember this, this is something we should keep track of for the future. And it stimulates parts of the lateral prefrontal cortex, which are a key part of imagination. And that's why sometimes if you're trying to create more or be more artistically inspired, just like, yeah, go be in nature, like go experience awe and it allows it easier to be more artistic. Or sometimes it might be to get that spark of imagination to figure out like some business problem or what app you want to write or what career choice you want to make. Because sometimes just sitting there and thinking about it more isn't going to give you the answer. Uh, I think one of the coolest aspects of awe is that it deactivated the default mode network is part of the circuit in the brain that's constantly, by default, activated. And it's thinking about our own emotions and thinking and wondering about other people. It's overlapping with that theory of mind network. A decreased our sense of self and it decreased that activity, which is also something that is caused by psychedelic medications like magic mushrooms or things like that. And this is one of the reasons, I think, why it helps improve altruism and our sense of connection with other people. Because like, oh, we kind of helps us like accept our smallness and our fragileness and vulnerability in the world. Which helps us realize like, oh right, all these other people are just like me. But also puts all of these problems that I'm having into perspective. Like I don't know if I can finish this paper on time or if I'm, you know how I'm going to hang out with my friends and do this or whatever. And it's like, oh, well when I'm staring at the Grand Canyon or I'm staring at the night sky and looking at these things that are billions of years old and millions of miles away. Like oh, I feel smaller but also like, yeah, all my problems feel much smaller and more manageable because I'm not activating the sense of self and elevating my sense of importance of myself. Which Yes, is sometimes helpful, but sometimes it means that we're activating how important our problems are as well. I'll end today with this concept of flow, which is not directly related to arts, but it is related to the arts as well as many other areas. And it was first defined by this psychologist, Hi Shika. M high. Difficult to spell. If you see it, you might not know how pronounce it, but that's how you pronounce it. He found that you've probably experienced this, he just described it when you're in those moments where you're just like in the zone and maybe it's like you're just writing and you're creatively writing and you're just like right for an hour and like time just seems to fly by or you're practicing music and you're just like fully enveloped in it. And time, you know, just flies by and you don't even notice any other distractions. Or sometimes in sports, you can be in that zone where like, oh, everything seems automatic and it's coming to you. And you don't overthink things and you just, you know, react. And everything feels automatic, but in a good way or when you're playing video games. And he described this as a flow state, which is sort of this very desirable experience that we often want to have. But it's not happiness per se, because you're not thinking about like, hey, am I happy or not, like no. You're just fully immersed in the moment. And this can facilitate artistic expression and creativity, but also, you know, athletic expression and all these other forms. Because we are fully immersed in the present moment. And it's similar to mindfulness. It's just that mindfulness is intentionally cultivating this ability to stay focused on the present flow is when we are in it and if we fall out of flow, oh, practicing mindfulness can help us get back and flow. But this process that's achieved when there's this perfect balance between the challenge that is in front of us and the abilities that we possess. So like imagine if you're skiing. Well, if the run that you're on is too difficult, you're frustrated, you're scared, and you're anxious. If the run is too easy, you're bored, and you're thinking about other things. Or the same thing if you're playing sports. Like if the team that you're playing is too hard, you feel overwhelmed and it's really hard to stay present and focus or enjoy it. If it's too easy or you just have practice or whatever. It's like too easy to like oh whatever. And you get lazy and you make stupid mistakes. But when we feel sort of most alive and present and focus is also the same place where we're at that Yerkes Dodson Peak, where we're at that good level of stress and we're in the zone and everything just feels automatic. And we can help facilitate that for ourselves when we either increase our abilities or decrease the challenge that we're trying to take on so that matches our abilities. But sometimes it's that like, as with many of you, you're so incredibly talented. And the reason why you're not in flow is because you're trying to do things that aren't that difficult. And you're like, huh, why aren't I more inspired? Because you're not excited about it. The challenge isn't big enough to meet your amazing abilities. And when we experience flow, yes, Sometimes we are trying to, you know, write something like a book or create something or win a game. But when we're in that flow, it becomes for its own sake, we just want to get back to that state just for its own sake. And yes, sometimes it helps us create more or win the game, but we want to experience it for its own sake. I'll just leave the second half of this poem. It's a strange poem, you can read the whole thing. The first part is kind of like this question alluded earlier that like, yes, sometimes art is weird. It makes you think and you're like, huh what? I don't really understand that, but I love the second half of this poem. I mean, I love the first half of this poem for that reason. But I'll just want to share the second half where she, she passed away a few years ago. But she said, I don't know exactly what a prayer is. I do know how to pay attention. How to fall down into the grass. How to kneel down in the grass. How to be idle and blessed. How to stroll through the fields, which is what I have been doing all day. Tell me, what else should I have done? Doesn't everything die at last and too soon? Tell me, what is it you plan to do with your one wild and precious life? And I'll leave you to it. Thank you.

Week 8 lec 2 (Lec 16)

Okay, so today's lecture is going to be a little bit different. It'll probably be a little shorter as well, But before we get into it, I just wanted to cover a few things about next week, a few reminders. The final exam is a week from today. It'll be similar format to the mid term, so you can start anytime in the morning up till around 08:00 P.M. So whenever it fits throughout the day, we know that you should at least have 80 minutes to do it. Because of this class time, I would encourage you not to just push it later in the day because stuff can always come up. But you'll have 80 minutes or whatever CAE accommodations, it will be focused on the material from the second half of the course. Sometimes students are like, so it's not cumulative. And I just like to remind me, make the distinction that the material itself is cumulative because, you know, we talked about stuff this whole quarter, we've talked about the prefrontal cortex, a lymbic system. So yes, that stuff will be on the test even though it came up in the first part of the quarter. It's just that the questions will be focused on lecture material from the second half of the quarter. Office hours are today as usual at 02:00 P.M. So if you have questions, that's a great place to ask them for next week. Just to give you more opportunities to ask questions, for preparing for the exam, I'm going to move off hours from Wednesday to Tuesday so that while you're preparing, you can come to officurs and ask questions. So those will be a Tuesday at 02:00 P.M. And also for Tuesday next week for discussion section. I assume your TAs would have talked about this, but you should bring a draft of at least the intro of your final paper. You don't need to know everything. You don't need to have all of the references. Just start writing that intro of your first paper so that we U can help make sure the TAs can help make sure that you're on the right track. And we're going to do a little peer review process in discussion section because really that's how science actually works. If you bring in your work and you show it to your peers and you hear comments and inputs from them, or I think those are all of the announcements. Yeah, so the last lecture for this class is going to be on Monday. So we're going to be focusing on today is just an overview of some miscellaneous topics that didn't fall into any specific categories for this class. But they're interesting and helpful and certainly related to the goals of this course. I originally created these slides based on questions that students had asked in previous quarters because I saw that there was certain information that students were still interested in hadn't fully been covered. Wanted to take this opportunity to talk about some of these things more in depth. This stuff is going to be on the exam or potentially is going to be on the exam. Maybe not the confidence and passion in your life path part, but things that are related to science that make specific points about the science you should definitely be aware of for the final exam. And then I also left time for some additional questions because I posted the fly flying around, so I couldn't tell she was waving her hand. I posted on the announcements to see if any of you had additional questions of material that you were still interested in or things you were wondering about. It was great that some of you filled out that questionnaire. I'm going to talk about some more of those today. But I felt like it was it's unfair to then test you on that material specifically because I know that as college students you have This dilemma where part of you is just interested in things and you want to take classes because you're interested and you like learning just because it's fun to learn and stuff is cool and awesome. And you also have this drive of like, well, I want to get good grades and I don't want to like make things unnecessarily difficult on myself. And I could tell that probably a lot of students are like, oh, I don't want to ask questions because then they'll just be more work and maybe I'm interested in it. But then if anyone else found out, found out that I asked a question and now it's on the test, they're going to be mad at me. So to just simplify all of that internal difficult conversation, the questions that people asked this quarter aren't on this exam. I don't know if, I mean, I assume we'll have time to get into all of this and then we'll probably end early. But if you have additional questions, happy to talk about them. And those things also won't be on the exam. And I think, I mean, overall, one of the goals of this class is to recognize that you have multiple motivations and that sometimes things are frustrating. Because you want things to be easy and you want them to be interesting and you want them to be meaningful and you want them to be fun. And you can't figure out how to do that all at the same time. But recognizing that those emotional conflicts come internally from your own desires and your own emotions is really helpful. Because otherwise, when we just focus on external things, then we think the only solution is just to change the outside world. Now I realize, oh, I have an incredible power to modulate my own brain and my reactivity to the outside world, even if I can't change the world. And for some things the best solution is to change your actions or change the outside world. And sometimes the best solution is to change your own perspective or your own emotional reactivity. Why was I saying that? Oh, yes. Right. Because in college you have a lot of external pressures and deadlines and it's great to recognize that you have to meet those, like I remember when I was in grad school. And maybe this belongs under the confidence and passion in your life pass section, but we can talk about it here. When I was in grad school, I wasn't sure if I was doing the right project or not. I didn't have a lot of confidence in my advisor if he was telling me the right thing. So I went to talk to the former head of the department to just get some advice. And he was like, what do you think the purpose of graduate school is? And I think it's sort of similar to the purpose of college. And I was like, ah, well, you have to, you know, do some important research on a topic so you can advance scientific knowledge in some very specific area. He said, oh, that's a very inspired answer, but the purpose of graduate school is to get a degree because you can't really do any of that other cool, amazing stuff that you're really interested in until you actually just get a degree, in this case, a Phd. And then you do a postdoc, and then that's, you know, does something interesting and then you can do your real work. And I think that's kind of true of college as well as well, like the purpose of going to college is to get a degree like you can learn without going to college. But the purpose of going to college is to get a degree. It will help you do more stuff that you like to do. The only issue with thinking only in those terms is that's purely sort of functional. And we often think about, oh, well if I just need a degree, then I can, what are the easiest classes I can take? What's the easiest way to get, what's the fastest way to get a degree. But then we're sometimes frustrated or dissatisfied because we have to step back and think about why am I getting a degree in the first place? Oh, because I'm interested in things because I want to make an impact on the world. Because I want to do meaningful work. I don't know, like you have multiple, oftentimes competing desires when we think back to that perma. Model. Yes, the perma model still applies, even though we talked about it early on in the quarter. Just recognizing that you have those multiple competing desires is very helpful. So the topics we're going to cover today, Dopamine, fasting, how to help others who seem to be struggling the brain get connection. Pain and pain processing. And some of the stuff I was just talking about, about confidence and passion in your life path. And certainly getting a college degree is probably part of that, but it's just one element. And then we'll cover some additional questions. Dopamine, Fasting is a topic I feel like it became really popular to talk about a few years ago. It's still floating around. You've probably heard of it, I guess. Who here has heard of dopamine fasting or dopamine cleanse? Yeah, most people. It's based in science and it's also sort of just pseudoscience and pop psychology. And so I just wanted to talk more about it so you understand what's going on. The idea behind it is that we know that lots of pleasurable experiences or stressful experiences release a lot of dopamine. Sometimes that can create problems. The idea behind a dopamine cleanse is to cut yourself off from all of these sources in your life, The stimuli that are boosting dopamine, so that you can not be just so driven by, you know, immediate dopamine needs and impulses and sort of reset your brain. One of the students asked in a previous quarter about my opinion about dopamine cleanses and how we can become less attached or addicted to our electronic devices and they want to know how the reward system is affected when rewards are anticipated but not received. I think it really comes down to the fact that dopamine is not good or bad. I think the key aspect of this question, whether should I do a dopamine clines or not do a dopamine clines, It's just simply recognize that dopamine is not good or bad. It's essential to your survival. It's essential to your excitement and your attention and your engagement and achievement, which are key parts of the perma model of well being. But yes, does it sometimes get in the way of things? Sure, So it's helpful to be conscientious of how you might be modulating your dopamine system in an unhelpful way. I think the traditional, or the sort of initial idea of a dopamine cleanse is a bit misguided because you're like, oh, I just need to cut myself off from I can't eat any enjoyable foods. And I can't look at my phone or I can't talk to, you know, my friends, or I can't listen to music or anything. That's like enjoyable going to stimulate dopamine. I think it became popular because that be really helpful to have a reset. One of the ways to reassert that your actions are intentional is to notice when you're impulsively just looking at your phone or impulsively listening to music, whatever. And then just say, oh, well now for 24 hours or a week, I'm just not going to do that. Therefore, if you can not do something, then when you do it, you can have a little bit more confidence that it's actually intentional as opposed to habitual or behavior that you are addicted to. It's sort of like if you're concerned that you're drinking too much alcohol, well try taking a break from alcohol. Can you do it? If so, then you probably have a better that probably reasserts your healthy relationship to drinking alcohol. The problem though, that I have with this approach of A dopamine cleanse is that it smacks of this issue that people often have. They're looking for a quick fix. Like I have all these problems in my life was like, oh I know, just like, don't lick my phone. Don't do all these things for like 24 hours and boom, that's going to fix everything. And just because it might be helpful doesn't mean it fixes everything. And it's very easy to fall back into old patterns. So some people and some researchers looked into this idea, but like revised it a little bit, which they called Dopamine, Fasting 2.0 to check in with these behaviors and circumstances that we may be engaging in impulsively simply because we're expecting that dopamine boost. Or we are used to a certain level of stimulation, because we see a level of stimulation, we're just doing it impulsively or habitually, but it may not be in our long term best interest. I think the answer is, is not just a quick fix. Let me eliminate all of these things and then come back and think, oh, that solved all of the problem. But instead revisiting your relationship and trying to create a healthier relationship with these things. Because many of these things are pleasurable and enjoyable. And there's one mode of thinking that's like, ah, right. You should just eliminate pleasure because it's bad to just, you know, want things or have these needs and be driven by them. And I think in a lot of the Buddhist tradition and a lot of meditative practices, we're trying to let go of our attachments to these things and that can be really helpful and powerful. I call that the Buddhist monk conception of happiness, which is nothing wrong with that. It's just that, okay, well if that's not what you want for your life, if what you want for your life is to enjoy a lot of these things and to accomplish stuff and you don't want to just release all attachments, that's fine. But just recognize when these attachments or the pleasure is getting in the way and when it is helpful because it is in fact the goal. So in my view, there's nothing wrong with pleasure. It's a key part of life and your well being. And it's not so much what you do, the specific activities that you do that matter the most, but why you do them so like, is it bad to eat a cookie? Is it bad to use your phone? Well, it certainly like releases dopamine and it might be pleasurable. But what do you mean by bad? And I think sometimes we get into these notions that I should just stop doing these habits because they're bad. But habits are not bad in and of themselves. They are only bad if they prevent us from getting to some important goal. And so we can ask ourselves what we can use our theory of mind. I'm like, oh, what is that important goal that this seems to be getting in the way of. That makes me think this is a bad behavior. When we start to reflect on why we are doing these behaviors, it can help us create healthier habits or have a healthier relationship to these behaviors, like eating a cookie. Nothing wrong with eating a cookie. And enjoy eating a cookie and it can be a very positive pleasure in life. It can be problematic if you are using that to avoid the actual problem at hand. I don't want to, you know, focus on writing my final paper. This is stressful. I'm stressful. Oh, I'm hungry. Okay, Well'm, hungry. Let me just go eat something. Oh, here's cookie. It's pleasurable, it's enjoyable. Or if you have other emotional issues that you are eating that cookie or just going on Instagram or whatever behavior you're doing, and you are telling yourself that you are doing it because it's enjoyable, but the habit circuit in your brain isn't being quite so honest with you. It's like, oh, yeah, yeah, yeah, yeah, that's great. Tell yourself that you're just doing it because you enjoy it. Like it knows, oh, the secret reason that you're really doing it is to avoid some negative feelings and it becomes a coping habit. Using things like eating as a coping habit or social media, or watching TV, there's actually nothing wrong with that either, as long as you simply recognize and acknowledge that is why you are doing it. So sometimes people have this notion that like emotional eating is bad. Not as long as you realize that, oh, I'm eating, because like I'm really emotional and eating this food helps calm me down. Great. That's nothing wrong with using that as a coping mechanism is much better than many other more destructive coping mechanisms that you could fall into. It's just as long as you're honest with yourself about your true intentions, then it's not a problem. It's only when we lie to ourselves and say, no, I'm doing it because I'm hungry, or I'm doing it because, you know I enjoy it, that it starts to create problems. And so, there are many reasons why we would engage in these behaviors. We can engage in them because they are productive. Like shopping. Well, I have to buy clothes, food. I have to eat food right then we do them because they're productive and that's useful. We do them because they are enjoyable and great, like you live in a wealthy society. Like you are hoping to get a job. You're gonna have money. Like there's nothing wrong with using that to enjoy your life. But those behaviors can sometimes also mask the real reasons why we are doing them. Which is to avoid negative feelings and, and as long as you're honest with yourself and occasionally challenge your own assumptions. So I had this experience I think I've talked about before, but when I was writing the upward spiral, maybe the workbook, I can't remember. I would like go to Des every afternoon because I was like, I've been working on this all day. Like I'm frustrated, you know, I don't know what else I should write. Okay, let me just go to De. After a while, I was like, do I need to eat two cookies every day? And part of me is like, no, that's bad. You shouldn't eat cookies every day. You, you know, that's a bad habit. And then I was like, but why? Like there's no reason to be judgmental of myself, like why is it a bad habit? And it's like, oh, it's a bad habit because I'm doing it, even though I don't really enjoy it, I'm doing it. I've programmed it to myself that oh yeah. It's about time to take a break from writing oh, what's yell, let me go to Ds and it is it helpful as a break, but I would find myself eating these cookies and I'm like, oh, like, you know, I didn't enjoy them or savor them as much. And so I did a little dopamine cleanse of that. Not saying, oh, I'm going to avoid all stimulation of everything but just like, hey, well let me just try not going to get a cookie like am I doing it because I actually want a cookie and that's the only way to accomplish what it is that I'm seeking. Or am I just doing it out of boredom? Am I just doing it out of habit? Am I just doing it to take a break from writing? So I was like, oh, let me just try for a week and not do it. And I could notice all of my emotions that were coming up and I would try to replace that habit with something else, like oh, let me just go for a walk, let me listen to some music and your brain when you try and challenge your own assumptions about your addiction to these dopamine producing things, it's really good, just like an addict in other areas, it's really good at convincing you that like, oh, hey, your plan to avoid this, that's stupid. Like come on, it's just a cookie. Like just go and like, this is where it's really helpful to check in with your own motivation. It's like, oh, that's interesting how much like strong emotion I have about this. It's probably more than just a cookie because I'm feeling like I have to go do it or I'm like really stressed or whatever about not doing it. But. All right. So after a week I started to feel like, okay, don't need a cookie. I'm not really doing it because I'm hungry. Like, I just need a break. So I just, I made a play list of songs that I liked. Get a little, you know, tingle of dopamine that way. And just go on a 510 minute break list of music and then come back. And I didn't need to eat a cookie, but after proving to myself like, oh I don't I could, it's possible for me to not do this thing. Well then at some other later point, I was, had a really stressful day and I was like, you know what, I really love, I love it was like Eminem cookies from Dries. And I checked in myself, oh, am I doing this because I actually want to do it. And I was like, yes, I would love a cookie. And, and I went and I got it. And it was amazing and delicious because I was doing it out of intention, not out of habit or out of or as some way to avoid some other emotion. Even though the reason I was doing it was for comfort and for enjoyment. Like that's perfectly. And I changed, you know, went from eating like regular, like frosted mini wheats. In the morning I was like, I'm just going to eat plain oatmeal And for the first couple weeks it was like really boring. And I was like, okay, I add some bananas and add some raisins and cinnamon. And it's like, okay, that's a little better, but it felt really boring and engaging and not fun to eat this. And then I noticed something that after a couple weeks, fruit started to taste sweeter. I didn't notice it at first, but at some point then I tried frosted mini reeds again and I was like, oh my god, this is like dessert because your brain gets calibrated to how much? Why does this keep happening? How much dopamine? I, was this still recording? Well, hopefully people who are watching the recording will get it. Let's see. Okay, preview u anyway, so that is one of the advantages of revisiting your relationship with these things, so you're not bombarding yourself with unnecessary dopamine that is undermining your ability to just experience natural rewards, natural rewards like food or social interaction. Or just listening to some music. If you're constantly increasing the amount of dopamine that's going into your brain, then it's very hard to just appreciate the simple pleasures. This is very much related to something we've sort of talked about and danced around, but I'll just talk about it more explicitly. And it's called the mesolimbic dopamine system. Dopamine is generally produced in the brain stem, in the mid brain. To be specific, that is what the so here means, the mid brain part of the Limbic system. Dopamine is produced mainly in two areas. The substantia nigra, which we don't really talk about much here that gets damaged, that leads to conditions like Parkinson's. A disease where you have trouble initiating movement. But the emotional and pleasurable and rewarding aspects of dopamine, those get produced in the VTA, the ventral tegmental area. We've talked about that before. This is the root of what's called the mesolimbic dopamine system, when we chronically release higher levels of dopamine because you're on your phone while you're watching TV, while you're drinking Coke and listening to music at a party, bombarding our brain with excess dopamine, that can lead to reduced dopamine release in the long term because your brain is like, oh, there's too much dopamine, we need to, you know, stop releasing so much. And so we don't overwhelm the brain as well as a reduction in the number of dopamine receptors because you keep getting all this dopamine, your brain's like that's too much dopamine. Okay, well let's just get rid of some of these receptors so we don't overwhelm the cells and the synapses, which means that now you need to keep producing more dopamine in order to have the same effect. And by disrupting that pattern and say, okay, well I'm just going to reduce how much dopamine I'm having. It might in the short term feel unpleasant or boring, but then your brain can recalibrate and then you can have a more intentional choice going forward. The O is called the mesolimbic dopamine system because it the neurons there that produce the domain project to a lot of key areas of the Olympic system, including the Amigdolaa and the anterior cingulate cortex. But they also project to parts of the prefrontal cortex like the orbital frontal cortex. And that's where a lot of the dopamine in the prefrontal cortex comes from. And how the prefrontal cortex can modulate our motivation, and we've talked about this before as well. That the dopamine that gets released in the nucleus acumbens when, oh, you eat that snickers bar for the first time or win money. That dopamine gets produced in the tegmental area. But it's not just that one simple connection. Dopamine that gets produced in the ventral tegmental area really goes all over the place. Um, from the Olympic system, the nucleuscumbents the prefontal cortex, and that is called the mesolymbic dopamine system. As you recall. Perhaps oxytocin that's produced in the hypothalamus projects to the VTA and modulates that. And that's why oxytocin can have this huge modulating effect on our attention, on our emotions, on everything, because it's targeting this key part of the mesolymbic dopamine system. And if we chronically activate that, and we need, you know, more excitement, more pleasure, to just achieve that same level of satisfaction, then it's much harder to just appreciate hanging out with a friend on a Sunday afternoon or going for a walk in the park. Those things don't inherently release as much dopamine in the short time. And so, you know, in the short term. And so instead we're like, oh, this is boring, I'm going to go to a party and meet new people and do this and like, that's fine. There's nothing wrong with doing that. But it becomes a problem if you're doing that. To just avoid boredom or it gets in the way of just the simple pleasures, you know, that's sort of a segue to how we can help family or friends who are struggling, which I think is something that probably a lot of you have experienced. So sometimes we don't realize how we are contributing to their struggle because we're bored or we're uncomfortable talking about this thing that they're talking about. And because we're so addicted to dopamine, they're like, oh, I just want to use my phone and then they feel rejected or I just like, I can't pay attention or whatever. Because you have so much addiction to dopamine. These things are and can be related, but if you have a friend or a loved one who is struggling with a mental health condition, we often wonder like how can I help them? What's the best way to help them? I think one of the most important things for you to keep in mind. Uh, is that you showing interest in their well being. And being a friend for them or being there for them is one of the most powerful things that you can do. We sometimes discount that or ignore that because you're like, yeah, but I want to solve, you know, I want them to take action. I want them to get better. I don't want them to go through, okay, sure. We can experience frustration or fear and anxiety that this person might not take further steps or might have other problems. That's right, That's perfectly understandable. Why? Because of how the stress response and the emotional circuitry in the brain work. This person is important to you because they're important to you and you don't have full control over them. Well, there are potential consequences and those consequences, without control, those create emotions. But the key thing to keep in mind is, oh, this person is important to me. That might create negative emotions and anxiety and frustration, whatever. But just reminder, oh, this person is important to me. And make sure that what I am communicating to them is that they are important to me and that their well being is important to me. Sometimes we inadvertently don't communicate that because they are important to us. That creates a lot of frustration in me that they can't get better. And so I'm like, hey, well why don't you just take a medication, or why don't you go to a talk to someone? I'm trying to communicate how important this person is to me, how important our relationship is. But what gets communicate, Ted, I, what they perceive is like, oh wow. They're really disappointed in me that I'm depressed, or they're really frustrated in me that I'm, you know, I can't take more action to fix this problem. Well, guess what, buddy? I'm really frustrated in myself. So now I have to deal with me being frustrated myself and you being frustrated with me. And so that's why it's so important to recognize, like it is extremely valuable simply to be there for someone to spend time with them. Even if you can't fix everything, your relationship with them is one of the most important things you can do. You can offer your support with care U. This is goes back to what I was talking about a few lectures ago about the differences between sympathy and empathy and compassion. We often have a empathy with someone, sometimes we do have a lot of sympathy or we don't validate their feelings because we're like, come on just like step out of it just like go exercise more, go to see a Dr. or whatever, and then we inadvertently invalidate their feelings. And that has a negative impact potentially on the relationship. So that's why it's also helpful to remember that sympathy and validating their experience is extremely powerful. Not just feeling bad for them, but to acknowledge that what they're going through is very difficult. And then also to act compassionately. And it's not just about acknowledging their experiences or offering advice. And this is what I mean by offer your support. With care, it's very easy to give someone advice, hey, you know what you should do. Well, guess what? Did they ask you for your advice? If they did not ask you for your advice, then you giving them advice is probably perceived as unhelpful or as a criticism. And sometimes we give advice because we're really frustrated that this person is not asking us for advice. And then again, so you go back to step one of like, oh, remember, you know, the most important thing is, is showing that I'm, you know, there for them. So focus on the actions that you can do is really helpful. Like how can I best support you in this moment? Or maybe you do the mental work of figuring out what might be helpful for them and either ask them about it, or then just do it like, hey, I'm making some lasagna. Can I bring you some? Or I'm going on a hike, Do you want to come with me? Because sometimes, like, someone is depressed and we're like, hey, is there anything I can do? Like they're depressed, they don't know what you can do. They don't want to ask you like, oh, hey, could you make me some lasagna? Like I don't. You know, like that's too much of an imposition or whatever. Like show through your actions that take helpful actions to help them. You are probably not doing that because you're like, oh, but I don't want to waste my time making lasagna. And then they'll say no, I don't want to feel rejected. If I say, hey, do you want to go in a hike? And then they say no, but you deal with that yourself, That's the best. And if you are the one who is not depressed or not anxious or whatever, like will you deal with those emotions? Because you have a better capacity to deal with those emotions than they do when they're struggling. And just making those offers is helpful, particularly as you validate their experience and not minimize it was like, oh, you just need to do this or just think positively or like, oh, but your life is so great, like well, their experience is their experience. You can show that you care about them. You can be there for them. You can't don't have direct control over them. But you do have control over what actions you take and how you go about that relationship. And again, it's really important to recognize your own intentions in this because sometimes I'm so frustrated by your struggles and my own empathy as a result that I like, I don't like these feelings that I'm feeling. Hey, you know what, The best, easiest way for me to fix these feelings that I have about you. Well, if you just freaked, go to the psychologist, then I would feel better, right? But then we like project our feelings onto the other person and the other person can sense that. It's like, oh, you don't necessarily care about me. You care about your own discomfort, and that creates a problem. So just recognize your own discomfort. Figure out other ways to deal with that so you don't project it onto them if they don't immediately jump at your support. Oh, thank you so much for coming in and saving me like don't take it personally. You might take it personally, but just so when I say don't take it personally, it's really notice if you take it personally, be mindful of that. And then remind yourself, okay, if I want to take this personally and get in a hissy fit and like pat myself on the back for how wonderful a friend I am and how terrible they are for not taking my advice, like go for it. But if the most important thing is this other person and not your own moment to mow feelings, then remember, oh right, well just being there and showing my support that this is about them is the important piece, not just making it about me. And that again, sort of goes back to like avoid offering solutions because it's really easy for you like hey, you know what, I just took this class called Po Positive Neuroscience and or I just read this book, The Upward Spiral, and was so helpful. So you know what you need to do. You need to exercise. I need to sleep right and you do all these things. And so I want to caution you, this is just a general caution and maybe you've already violated this from having gone through this class. But really important self help and self development directed at your self. And because you have this experiences and this knowledge, it's really tempting to just tell other people about them, but you don't have their experiences. You don't understand like why they can't do something. Perhaps why it would be so stressful or anxiety inducing to go to therapy or try to medication or whatever. And so you just offering your solutions from your perspective is actively unhelpful. A lot of times the only time really when offering help is useful is when the other person is asking for your help or guidance. But because we're so eager to give our insight and our suggestions to deal with our own discomfort, we often don't actually listen to see like, are they interested in that? And so again, the first step is to show with your actions that you care about someone. And when you do that, then sometimes like, hey, what do you think I should do? Go oh, you, you know what I found helpful. And you can talk about your own experience, but you know, you can ask them. You know, I went through something similar or I know I took this great class. Would you like me to share some of the things that I heard about will then? Yeah. They might say yes or they might say no. But generally, don't offer solutions unless someone is asking you for your solution. This is kind of also true, not just in interpersonal relationships, but probably in, you know, bigger political issues, okay? You know what Israel should do? Well, you know, maybe sometimes people take offense because like nobody asked you and you don't know all the details. Somebody else is going through and that's perfectly fine if you want to spout your opinion. It's just helpful to remember like, oh, well, if someone gets bent out of shape because I told him like, oh my goodness, I was just trying to help. Okay, well, were you trying to actually help or were you just trying to be right? Because it felt good to say something. And that's where it's just helpful to recognize this comes in a lot of interpersonal relationships, but also in a lot of political disagreements. That again, it really comes down to just recognizing that you are not 100% right about everything. And just being curious is a really powerful way to move forward. This brings me to the brain gut connection. This is all about how what is happening in our brain affects our gut and our digestion. And what is happening in our digestive tracks and our gut affect what is happening in the brain. So we've talked a, the first part of this earlier in the quarter when we were talking about the autonomic nervous system and the sympathetic and parasympathetic branches of the autonomic nervous system, that when we are stressed and anxious, those nerves in those nervous systems project down to our gut and either speed up our digestion or slow it down. This is you're stressed or fearful, or anxious. You could have stomach pain. Why? You could yet diarrhea or constipation, depending on the chronic nature of this, is not simply the food that you are eating. It is your emotional reactivity that affects your digestion. And it turns out that this is a bidirectional thing. You may have heard that you know, 90% of the Seratonin produced in your body is produced in the gut. Either within connections within your gut or connections from the gut to your brain. So it's not just serotone in the brain, it's not the only place it is. And it turns out that changing what you eat can improve depressive symptoms. That's an easier thing to measure because I can just take a bunch of depressed people and give them different diets and see, oh, does this change their depressive symptoms? That's an easier connection to see. Understanding the mechanism of how that works is much more complicated. But the fact that does seem to work, that's more clear, but how it works is less clear and there are a few possible mechanisms. One is by changing what's called the micro biome, which is the types and amount of bacteria that you have in your gut. One of the most fascinating facts I think about the human body is that there are about three pounds, I believe, two or three pounds bacteria in your gut. They help you in a lot of ways. Sometimes they can cause problems, but they generally help you break down and create a lot of chemicals that you couldn't create on your own. Because bacterial cells are so much smaller than human cells, you actually have more non human cells in your body than you have human cells. You have many more number of bacterial cells in your body than you have human cells. I think just a fascinating fact about the human body, trillions bacterial cells help your body in the creation of numerous different chemicals that influence your body and your brain. What you eat can change the types of bacteria you have, which can in turn boost your mood. One candidate for how that works is through serotonin. That we can by what we're eating and changing the micromar, change serotonin signaling to the brain or make more. Tonin or other key neuro transerters available to the brain. Or potentially by changing nerve signaling to the brain because we know the Vegas nerve goes to the insula and that we have this biofeedback where your brain tells your gut what to do and then the insula is constantly paying attention to how is my stomach feeling and changing its behavior based on what we're eating or how reactive your stomach is. Your stomach could maybe react first and then your insulin is like, oh, that feels bad and your magdela freaks out about that. And that creates stress. And then that changes your digestion, which keeps that loop going. And the foods, the type of foods we are eating can sometimes calm that loop or break that cycle. And these studies that have been looked at this changing a diet not to lose weight, but to just see how, oh, changing the kinds of food we have could change our mood. For some people, maybe that would help you lose weight, but like even if you didn't lose weight, you would just be happier. Um, so sometimes you could ask yourself like, well, you know, what is my goal? In one study, people who made these certain dietary changes had about double the improvement in reducing their depressive symptoms compared to a control group. What kinds of food or what kinds of dietary changes do they make? Well, not that surprising, but generally you want to try and eat more real food and less processed food. Eat more whole grains and beans, fresh fruits and vegetables. Dairy did show to have a particularly beneficial effect on the microbiome you might have here. You know, people eat Keifer or yogurts of various kinds because they change our microbiome, Eating lots of healthy fats and, you know, avoiding excess alcohol or caffeine, excess sugar or just processed foods in general. It, again, my hesitation about talking about food is it's very easy to moralize this and say, this is good food, this is bad food, I'm good for eating this, I'm bad for eating this. And that is unhelpful. You want to get away from it? So these are just general sort of guidelines. It's like, oh, I wonder why I haven't been feeling as, oh, maybe I could just make these subtle shifts in, you know, in what I'm eating and that might help. Oh, I haven't really eating many fresh fruits and vegetables like oh, I've been drinking a lot of alcohol or eating a lot of excess sugar. I'm just sort of like gently shift that. So this is sort of like, you know, guidelines not a specific diet because often more important than what we eat is how and why we eat. So we can get into this conflict. Sometimes it's like, oh, my mom makes this amazing stew or dumplings or whatever and it's like, ooh, but that has, you know, that has more, you know, red meat and it's, oh, I can't do it. And we get into this whole argument, conflict with ourselves like that's not healthy and there's actually a whole eating disorder now that if you go too extreme in that, like you're an obsession with eating healthy, it's called Orthorexia because, yeah, it's good to eat healthy. But that's not the only reason why we eat. It's not just chemicals that we're inputting into our body. We also eat to connect with people we eat, to calm down. We eat because it's socially culturally meaningful. We eat because of enjoyment. And if we are only focused on eating because of health and often misguided views of what health means, then we often suck all the enjoyment and connection and meaningfulness out of what we eat. So again, what you're eating, yes, it is a part of it. But don't go overboard and just, you know, forget about the pleasure and meaningfulness and connection that often comes with eating. And for me, the things that helped me make some dietary changes like the, you know, not going to rise every day or just eating less meat in general. Was realizing the habits and how impulsively I was doing these things and it wasn't out of what I actually wanted. So all it required was just eliminating the cookies that I didn't really want to eat in the first place or the meat. That I didn't really want to eat in the first place. So anytime I was like, oh, I really I'd love to go to Korean barbecue. I'd love to. Okay, sure, great. You can do that. And it's just when we have these habits like, oh, I have to eat that. Oh, I'm not really hungry but I'm supposed to like, okay, if you want to eat for fun, great. If you want to eat because you're hungry, great. Like just recognize that you have multiple motivations. And it's easier to make those changes when you stop judging yourself and being so self critical. By the way, one of the interesting things that isn't on here, but it's sort of interesting how it relates to the microbiomes. Diet sodas, diet sodas cause changes in our microbiome that may not be healthy for us. And sometimes we're like, oh, but I'm not eating extra sugar. But your brain is expecting sugar because it tastes sweet and then it doesn't get sugar, and so it can cause changes in how you process insulin and other things. So it's fine if, you know, you do it for other reasons, but also sometimes it comes with caffeine. But in general, one of the problems with diet foods or low calorie foods is they don't really accomplish any of our goals. Do you know if you eat a low calorie chocolate snack? Well, it doesn't fully satisfy your desire to eat chocolate, so it's not as fully satisfying. You don't enjoy it as much. And therefore, thinking back to what we had talked about a few lectures ago, like it's hard to get enough of something that's almost the right thing. And so we don't fully enjoy it, but it doesn't fully satisfy so that we want to keep doing it. And so oftentimes the best way is like fight. If you're eating a food because you enjoy it, then eat, eat the most enjoyable version of that and fully be present and savor it. And then don't judge yourself because you just simply because you wanted to do something that you enjoyed. Which is how we, sometimes, you know, this goes beyond food. Sometimes we eat a food or we take a break and we, you know, watch TV. And then we don't get to fully benefit from those breaks or those positive experiences because we're like, oh, it was wasting time. Well, if you wanted to be productive, you could have done homework. What you wanted to do was enjoy your weekend and you accomplished that. So don't suck all of the fun out of your enjoyment, because then you won't have as much productivity or focus to rely on when you need it. So this brings me to the concept of pain, which is a complex issue. It's a very prevalent issue for a lot of people. 20 to 30% of Americans suffer from chronic pain issues. I just want to differentiate this idea of chronic pain versus acute pain. We'll talk about a little bit more of what that means in the next slide. Acute pain can be like, oh, you've got to cut or some other wound, or you have to get surgery or your tooth pole or something. Chronic pain is something else entirely, and it is about how your brain interprets signals coming from your body. And chronic pain, it turns out, is very poorly treated with opioids. Opioids are fantastic for acute pain, but problematic for chronic pain. And chronic pain has this unfortunate downward spiral effect, where chronic pain can lead to depression, but depression also increases your sensitivity to pain. And chronic pain can make it difficult to fall asleep or stay asleep because your sleep is disrupted. That increases your pain, which also increases depressions. Ever present levels of stress and how your brain are responding to those stressors can make it even worse. And one of the reasons why opioids are particularly problematic is not just that they don't fully treat chronic pain, but that the way your brain changes how it adjusts when you take exogenous or external opioids, actually makes chronic pain worse. Your brain can produce its own endorphins, but if you start taking which are opioids and if you start taking opioids externally, your brain can essentially say, oh great, I don't have to make as much. And then you become more dependent on these substances because you're not. Producing your own pain killers. It's crucial to recognize that when we talk about pain, there are two different ideas that we're talking about. The difference between the signaling of pain from the body to the brain versus the perception of pain, which is a process that occurs within the brain. Most of us have a very linear conception of pain, where you get cut and there's nerve fibers in your hand that say that you cause damage, you shouldn't do that. And it sends a signal up to your brain, which your brain interprets as painful. Those sensors in your body are called no susceptors. There are specific pain receptors throughout your body to make sure that you're not damaging your body. There are people who don't, who have disruptions in that pain signaling. And they actually have very difficult lives because they inadvertently hurt themselves all the time. Or even simple things like while you are sleeping, your brain can sense op, this is an uncomfortable position for my shoulder and you'll just sort of adjust. And so people who don't do this properly, they can be really disfigured and have a lot of impairments because pain is extremely helpful to making sure that we survive and that we don't damage our bodies. But it's possible that you could have signals coming from your body that's saying, hey, you're damaging the tissue and your brain actually ignores those. Like if you're playing sports or you're having fun wrestling with your friends, well, like you get hit or whatever, like there's pain, like the signals are coming from the skin and the muscles is like, oh, don't do that, but your brain just ignores them. It's like, hey now, don't worry about it. We're just playing some football. Oh, we're just doing some fun stuff. Or maybe, you know, you're running into a burning building to save your child or your friend and there's, you know, embers and things that are burning you. And you might not even notice them at all because your brain's like up, that's not relevant. Like we got to save, we got to do this mission and you won't even notice the pain at all. So the signaling of the pain is there. But based on how your brain is processing it, there's no perception of pain, at least in the immediate moment. Because pain is processed in several different areas in the brain. They're the somatosensory areas, those are, you know, they're just constantly paying attention to, you know, what's going on with the body. But the tubes, as far as pain are the insula and the anterior cingulate. And so the insula, it's noticing pain, you know, from your body but also from your internal organs. My stomach is hurting and the anterior singulate is like, oh, either like that's really relevant to what we're doing right now and therefore we need to pay attention to it, or what's not relevant, like I'm gonna run into this burning building and save this kid. Or like I'm going to, you know, go for it on fourth down. So like, let me just ignore that pain because it's not relevant to what I am doing. And your brain is constantly trying to figure out what is relevant or not, and it really depends on how meaningful and committed you are to your goals that will upregulate or down regulate that pain. Because if you're like, if you don't have any specific goals or you don't have any specific opportunities, you don't have a job to go to, you don't have a lot of social contact. Well then your brain can actually upregulate this pain, like, oh, it's kind of painful but your brain's like, oh, that's really bad. And this is what happens in chronic pain, that things that you would normally experience is just kind of a little bit of discomfort. Your brain is like, oh my god, that's painful. You're not making it up, but the brain circuits that process pain have become sensitized. And it gets to the point even where normal signals coming from your body that you would just usually ignore. You're constantly getting signals from dose receptors in other parts of your body that you just ignore because you're paying attention. But if your brain starts amplifying those, then there might not actually be anything wrong with your body, and yet your brain is interpreting it as pain. And this is why you might, you get whiplash or something. You go to the Dr. and the doctor's like, oh, you didn't MRI, there's nothing wrong with you, it's all in your head. And they become very dismissive in invalidating it because a lot of, you know, physicians don't really understand the complexity of pain. But you don't necessarily have to have something specifically visibly wrong with your neck for you to experience chronic pain of your neck because your brain has Amplified those signals. And normally when you turn your head and it's just, you know, it comes with pressure, changes in, you know, stretch receptors or whatever that you just ignore. Your brain is now interpreting those as painful. And then because of this whole loop, you can get stuck in this pattern of chronic pain. And the way out of it is often not through medications. I mean, though some medications is generally not opioids, but some medications can be very helpful to just turn down the reactivity of your nervous system. Like selective serotone reaptake inhibitors which we generally think of as antidepressant medications. But Right, they're not targeting the pain directly, they are targeting how your brain responds to that pain. But also all these other stuff that we've talked about all quarter about how to regulate your nervous system. And that brings me to this topic I was talking about earlier about, you know, how to be confident in your life path and feel like you're on the right goal. Yeah. And so, you know, yeah, if you have to go, feel free to, to go. This isn't really going to be on the exam other than these aspects of science. You should probably know that science is about oh, you observe some things, notice stuff, and wonder, oh, maybe this is an explanation for that. And you come up with a hypothesis. And then you do an experiment. And the experiment gives you data, new things to observe. And you're like, hi, I wonder why that is. And then you just keep that process going. And that's how science works. I would encourage you to take that same process and apply it to your life. We've already been doing this. We've asked you to already do this in this course. We've asked you to observe your emotions or your sleep or your energy levels. You stay and you just write them down. That helps it make more scientific simply because it makes it harder to lid yourself or misremember. But you're just observing your own experiences. Then hopefully at some point and when we did sort of force you to do it with these weekly logs, but the more important process is actually just thinking or reflecting about it. Using your own mental processes to be like, huh, that's interesting. I notice I've felt really, you know, demotivated for the last six months. Oh, is that because I, you know, I'm in the wrong major like, or is it for some other reason? I just Oh, I forgot. I've, you know, have an exercise at all. I don't know. You can't actually know either. But you can get a better understanding of yourself by using this scientific process. Because whatever thought you have, your hypothesis, you're like, huh, maybe I'm demotivated because I'm in the wrong major. Okay, well I've already changed my major twice because I was demotivated about. Oh, maybe maybe the answer is, I just need to exercise more and, you know, relax a little bit more and hang out with my friends more. Oh, and then they'd be more excited about what I'm majoring in. Well, those hypotheses suggests specific experiments. If you hypothesize that the cause is that you're in the wrong major, well then the experiment would be like, oh, I need to change my major. We've already done that. Maybe that's not the answer. Maybe the answer is somewhere else that you're not looking. And so you could hypothesize, oh, maybe it's just I'm not exercising enough, maybe I'm not getting enough sleep. Oh, well, those imply experiments. Not that you should think about those experiments, but that you should actually do take action on, in taking action. Oh, it teaches you something. The problem is we don't usually learn anything. Because what we're trying to accomplish a lot of times is we're trying to have the correct answer the first time. We're like, well, I want the thing that I'm majoring in to then be the thing that I get my first job in. That's the perfect career that makes me rich and happy and gives me a lot of time and flexibility and is really meaningful and fun, okay? But you don't actually know enough about yourself or about this career to know whether that's possible. And we put a lot of unnecessary stress on ourselves because we're saying my first decision has to be the perfect best decision or everything is messed up. And it's helpful to realize like your major doesn't really have much of an impact. The rest of your life. Sure. Don't major in something that you know you hate and that you don't want. But other than that, it's okay. Well, you discovered you like some things about it. You don't like some things about it. Okay. Well, so then use that information, Don't just get mad at yourself. Oh, I didn't pick the perfect major, say oh, okay, well what did I like about this major and what did I not like about it? So that when you were choosing a job, you can take that into account and you try stuff. And the way to try stuff is not simply by taking a class in it or by majoring in it. Those are big experiments which are fine to do, but you got to do little experiments like talking to someone who does that job or reading an article about it on the Internet, or, you know, spending 5 minutes googling something or just reading a book about it on your own. And then one of two things will happen. Either you will like it more or you will like it less. But the only way to know that is by noticing your own emotional responses and being curious. And we can't do that if we're like, read one article and be like, okay, this is going to be the career that I choose. Well, there's always like, the data is always noisy. So if we are saying no, I'm only going to accept data that is perfectly clear one way or the other, then you're rejecting and ignoring a lot of powerful messages that your brain is trying to tell you. And a lot of times the way that you get to the place where you want is not a direct path, but it's like just trying different stuff. I major in neural science because I was like, oh, that seems cool, but I had a real struggles \*\*\*\*. Major in neuroscience or major in English. Because I really liked writing and it seems in retrospect the answer is obvious, like wow, you wrote a book about neuroscience, so you had it all figured out. Not at the time, I was like, oh, I'll major in neuroscience because that's cool. And the interesting neuroscience classes require that you take the boring neuroscience classes. Whereas English, I was like, oh, I don't, I don't want to study Chaucer. I hate writing essays. I just like creative writing. Oh, I'll just take a few creative writing classes and so I just did that and then I got a job in neuroscience and I just, you know, wrote on the side. In grad school, I was, you know, doing some writing but I was like, I don't really like scientific writing U papers. I don't really like writing essays. I do like creative writing. And it didn't take me until I was like, you know, finishing my Phd program. I was like, maybe I could write about science in ways that are fun to me And I just started a blog. I didn't have any specific. I was just trying to, oh, I like this. I'm not sure how I can get it to fit together, but I never would have reached this point to where I'm at of figuring out how to put it all together if I was like, no, I liked these two things. I have to figure out how to put them together because some things in your life will, will be your career and some things you'll just do because you like them and that's perfectly fine. And I think it's harder. I mean, it's always been hard, but I think it's particularly hard for your generation because of social media and that we think I can't just do something simply because I like it, Like other people like you can only do it if you're good at it or if other people tell you you're good at it. But let's say, you know, if you like music and medicine, well maybe one possible future is you become a Dr. who helps use music to treat people? Maybe you just, you realize that music is more important to you, become a professional musician. Maybe you're just a regular Dr. but you take piano lessons on the side. I don't know. The point is you don't know either. And telling yourself no, I have to pick the one perfect solution and know it right now often prevents you from being curious and learning about yourself. And if you still just keep practicing that process, then what you will get better at is understanding yourself. And you will have a better mental model of what it is that will actually make you happy. And how to find that right balance of the perma model of yes, you need positive emotions and engagement and meaningfulness, but you don't have to get them all from your job. Maybe sometimes we're lucky and we do. But if you understand yourself better and keep this process going, then you'll figure out how to consistently get that for the future. So yeah, So I guess we didn't have time to get into all these additional questions. Some of these are sort of related to stuff I talked about, but happy to talk about them in office hours or if you just want to talk right now. Okay. Thank you.

Week 9 lec 1 (Lec 17)

Okay, welcome back. Okay, so as a reminder, this is the last lecture for this class. Wednesday is going to be the final exam. I'm going to have office hours tomorrow just because they're less useful on Wednesday while you're taking the final exam. So if you want to stop by and ask questions or clear anything up, they're going to be 2-315 tomorrow. I extended them a little bit just in case people discussion sections overlap with that. Today we're going to be focusing on culture. We've started this quarter with the most microscopic elements of literally microscopic elements of neurons. And built our way up through individual personal things that you can do to modify your own brain and sort of broaden it out to relationships. And now we've broadened it out even further into the culture society that surrounds us. That's what we're going to be focusing on for most of today's lecture. And then we'll reflect a little bit on the journey that we've come through. Because each of these pieces are an integral part of the whole thing. It's important to realize how that all fits together. I guess just one of my main probably say that term a lot. But one of the main takeaways to realize this is just the scientific method. The scientific method is based on, well, you take all the stuff that other smart scientists have figured out because why not? Why repeat something else that someone else has already figured out. And that's your starting point. But then from there, you're stepping into the unknown, IE, an experiment that nobody else has ever done before, which is hm, I wonder how to make my unique neurobiology thrive and be successful and be happy all at the same time. So you could start with what science has already uncovered about how brains in general work. But nobody can do that experiment for you. And so you can reflect on other science, you can reflect on the data that you've been collecting about yourself for the last 20 odd years. And then you can experiment. And what we've covered in this class, we're like, hey, here are all the different places that you can reflect on or experiment with. Some of this stuff you can change. So try adjusting some of those variables and how much you exercise or, um, how you use social media, for example. Some of the stuff you can't change because it's stuff that happened long ago or it's just the culture that you are embedded in. So that's why we're focusing on that today. Culture affects so many aspects of our emotions and well being. It helps us learn what emotions are good or what emotions are bad, or how we should express them. It causes us to focus on certain issues or problems as important and dismiss other ones or ignore others. And this is very much connected with what determines our well being. Part of this is to bring it full circle back from something we learned in the very first lecture about the perma model of well being. That it's not useful to just think about happiness and positive emotions though. When you're stressed or struggling, that's usually what we focus on most, either positive emotions or engagement. But the culture that we are in sort of dictates or makes easier or encourages us to feel certain positive emotions and to express them in certain ways. Or that certain activities are things that we should engage in or how we should engage in them, and how we should relate to other people and what is meaningful. In fact, a lot of the history of our cultures and society provides the meaning of the behaviors that we engage in. If I was like, hey, why don't you go drag a tree into your house and hang some shiny balls on it? Like that? Sounds like fun. I mean, it might be fun, but it is meaningful because of not just your own personal history and experiences with Christmas, but also the stories and the traditions that you get from your family, from the people around you, from the media, from everything. Same thing with like, you know, lighting Hanukkah candles. Oh, oh, cool. It's fun to light candles. Right. But it derives meaning from the culture that supports it. Oh, this is a tradition that goes back thousands of years. Oh, this is a specific reason why we are doing this. Cultures also affects are the accomplishments aspect of well being. Because it tells us what goals are worthy of achieving what we should be trying to accomplish. What is pointless to accomplish, or even how important it is to accomplish something in the first place. And we're going to discuss this more that a lot of these things differ across cultures. And it's not that the culture that you are in is better than another culture, that you should find some other culture to move to you. That's certainly possible, but a lot of this is simply understanding the effect that the culture, either that you are raised in or the culture that you are currently in is affecting you or how it is affecting you. And you might not always have the ability to change that, but you can recognize oh, how it is affecting me. And if at any point that diverges from what you would like to see for yourself. Oh, well you can't necestuily change the messages that you're being inundated with, but you can reframe how you think about them or change your actions to protect yourself from them or decide you're going to move somewhere else and extricate yourself from it. This guy, Shimi, who we've talked about previously when we talked about the concept of flow, he's a famous psychologist. And he said that the joy we get from living ultimately depends directly on how the mind filters and interprets every day experiences. You have a lot of everyday experiences. You experience them every day. I mean, you walk to class, you go get lunch, you hang out with your friends, you study. But do you experience that as joyful or boring, or frustrating? It really depends not just on the actions that you're taking, but how your brain is reacting to those and how you're perceiving those. And a lot of that is influenced by the culture and the cultural expectations that you grew up in or that you exist in currently. For example, even the concept of going to college like you would probably, if someone asked you what you were doing with your life at the moment you're like, I'm studying to, you know, become a Dr. or I'm, you know, majoring in world arts and cultures or I don't know, whatever it is, there's some amount of part of you that feel a sense of pride. She's like, oh yeah, I'm accomplishing something. I'm reaching towards something important in the future. And part of the reason you feel those positive emotions is because in our culture, we generally appreciate and give positive feedback to people who are trying to improve their lives or have an impact on the world, or going to college to study something. So you've internalized those cultural ideals and that's why you feel good about yourself for doing it, though it's not quite as simple. But that's part of the reason why you would feel proud of yourself for accomplishing things here, or even getting into CLA, because of the culture that you grew up in. If you grew up in a culture that was like, uh, education is pointless and it's a waste of time and it's self indulgent, Then you might feel different. And perhaps some of you have complicated feelings like, oh yeah, I really want to make money. Oh, but I also want to like take over my family business and we feel conflicted. And. A large part of what I'm trying to teach in this class is oh, well, conflicts are unavoidable. That's why we've talked about difficult conversations, not just with other people, but within yourself. The most helpful way to resolve those is to acknowledge that you have different values and sometimes they compete with each other. And that creates negative emotions a lot of times because you can't have everything that you want exactly when you want it. But some of those emotions that you're feeling are, are primarily shaped by the culture and some are unique to you. And it's wonderful when we don't have to make a choice. When everything in our life lines up. When the thing that I am really excited to do is also the thing that is really fun and engaging is also the thing that will make me a lot of money. Which is also the thing that my parents are like, oh my God, I'm so glad that you're doing that. And it's also the thing that everyone else is like, oh bravo. And we get all this positive cultural approval and we're often desperately trying to find that one thing that's going to solve all of those issues. Sometimes that doesn't exist. But that is one of the reasons why many people are like, oh, I want to go be a Dr. Yeah, I kind of want to be a Dr. But also, oh, I could make a lot of money and it'd be, you know, feel meaningful. And people would tell me how great I am. And it's just that sometimes these cultural expectations, whether they're from the broader culture or just from your own family culture, are so dominant and loud that you can't even figure out what it is that you actually like. And this is one of the reasons why many people, and you've probably had many friends or maybe this is you as well. I know I'm going to go to medical school, I'm going to go to law school or whatever. And they had this big goal and then they burn out and they totally lose direction and paths because they never really wanted that in the first place. They were just following this sort of pattern that was shaped by their culture. Culture includes the behaviors that we engage in the traditions, our attitudes towards other people or to certain kinds of events, or how we should respond in uncertainty or whatever. And also the food that we eat, the types of activities that we do, and so on. And scientists have looked at various cultures because various cultures emphasize our relationship to each other and our relationship to the world in different ways. We can research this and see, oh, our different cultures better at improving subjective well being. Like we can go to all of these different people in all of these different cultures around the world and ask them about their own subjective well being, their happiness, their life satisfaction, and so on. And there are a few factors that different cultures may have that have a big influence on the likelihood that any individual from that culture will experience a high degree of subjective well being. I should preface this by saying that whether or not a culture is effective at promoting subjective well being is probably also largely a function of whether that is a value of that culture, whether your own individual well being is something that should be promoted because of the culture that we are in. That often sort of seems like a ridiculous question. What, what do you mean like shouldn't we all try and be happy and productive? Like, that's the whole point of this class. And it's just important to recognize like oh, well there are certain assumptions that you just sort of take to be true because of the culture that you are in. But it is different in different places around the world. So one of the biggest things that people focus on is often development and economic development. How wealthy a country is. Because it certainly seems we value having money. And we can see all of the things that money can buy you, education, laptops, cars, watches, clothes, all this wonderful stuff. And we're trying to boost our economy so that people can have a better quality of life. We also see the value of education to help people become better citizens. To learn more, to you know, all the wonderful things that you understand about education. We also can understand the importance of human rights. That we should, that's probably an important thing. To value human rights and not violate those rights. We might disagree about what those specific rights are like, in what situations they might not apply, but that seems like an important thing that we should agree, like yeah, people should, we should promote human rights. And yet all three of those things, GDP, which is a gross domestic product measure of how wealthy a country is or how much a certain culture values education or values human rights. All three of those things combined only account for about 9% of the predictive power of whether or not a culture is effective or good at promoting subjective well being. So in this study, they went to all of these different regions around the world and interviewed people from all these different cultures. And so they can see, oh, you're super happy and you're miserable and you're kind of okay, and whatever, not to single anyone out. But then they can see, oh, you know, group people by culture and see what's the average level of subjective well being. And we can see, oh, well, this culture has, you know, really high economic productivity. And this culture values education. This culture is terrible at human rights and whatever. And we can see, oh, well all of those combines. We look at all of the variation in subjective well being across the world. All of that only combines to predict about 9% There are a couple other factors that individually are at about that same level on their own. One is this concept of humaneness, which is the degree to which a society encourages and rewards people within that society for being fair, or altruistic, or generous, or generally kind to other people. You know, that might a lot of times go along with human rights, but if, you know, violating human rights, but within your culture, you're generally encouraging everyone to be fair and kind and supportive to each other. Well, that's going to actually increase the subjective well being within those individuals. Performance is another factor that has a big impact on its own. And it means the extent to which a community encourages and rewards innovation, high standards and performance improvement. This is most closely connected to the achievements, or accomplishment aspects of the perma model if a certain culture. So it's like, yeah, it's good to achieve things, it's good to get better at things. It's good to have a high standard of performance. People in those cultures generally have a high degree of subjective well being. And I would say, well, UCLA probably has a lot of same things, or the United States in general, we have a high degree of performance and value achievement at that is in many ways a good thing. Sometimes it gets in the way if it differs with your own individual brain or goals. But being in a culture that values those things is generally helpful. But the biggest individual contribution is probably something that you haven't heard of before, doesn't really make sense when I describe it. But in all of these other things, it's higher. Gdp, higher education, higher value on human rights performance, higher humaneness, all lead to higher personal well being. But in this case, this concept of distance, a level of power distance, leads to higher subjective well being. Well, what is power distance? Essentially, how much distance do I believe there should be from any average person and having the person in charge. It's the degree, as it says here, to which individuals expect, and degree that power be unequally shared. That's why. Power distance, you have a distance of you or the average person from power. A higher power distance means that power is concentrated. The simplest example of that is a king or queen, who they have all of the power and no one else does that. The extreme of power distance on the other end would be more egalitarian societies where power is equally shared amongst everyone. In societies that kind of agree that power should generally be shared equally. They have lower power distance and higher individual subjective well being. Good examples of those are democracies. Functioning democracies I should say. Because you could call something a democracy. And yet power is really just concentrated in the hands of a few. Like I think Russia is a good example where they have elections. It's democracy, but you know, it's, the power is really concentrated in Putin and in the oligarchs who control a lot of things. You could make the same argument about the United States. We generally have perhaps a little bit more, I mean, not a little bit more. We have a lot more shared power than Russia. But you could make the argument like, oh right, But you know, yes, everyone has the ability to vote. But because of economic inequality, some people have a lot more power. But the important aspect here is actually the economic or power inequality. That's the problem. The degree to which we expect that should or shouldn't be the case. If you're like, ah yeah, we shouldn't have all of the power or money concentrating a few people and everyone agrees with that. All that can still mean you have a lower power distance because you're like, no, this shouldn't be this way. So whatever your beliefs about our government or other governments is just helpful to recognize like oh, the degree to which everyone in a society kind of thinks that, yeah, the average person should have some amount of power. Those societies are generally happy on an individual level. And then there's this last piece, which is almost as big as power distance, but it's a belief in higher gender equity degree to which society minimizes gender role differences. To me, this is actually just another extension kind of the power distance. Like these two combined are huge, but they think they're sort of connected to the same idea, which is power distance is the belief that, yeah, you know, lower power distance is the belief that yeah, everyone should generally have some power to control their own lives or destiny, or vote or whatever it is. And then the gender equity part is. Yeah, And that should also apply to women and people of all genders, which is also an important aspect in individual well being. Though again, I'll reiterate that the notion that a society should be trying to promote the individual well being of its citizens or members like a well, that is also a cultural value was one of the challenges of living in a multicultural society. Well, which of those things do we need to promote in order to actually live peaceably with everyone? Whereas if there are some cultures societies like oh, we don't care about living peacefully with everyone, but to what extent do we need to impose our cultural values on another culture in order to protect our culture? And that's not always an easy choice. But that also relates to, I think, a lot of inner turmoil or conflict that we feel when thinking about politics or bigger world issues, or certainly when talking to other people about these things. But it's helpful again to start with yourself. Notice your own emotional reactions to those things and your own discomfort. Because ideally we wouldn't have to make difficult choices. I mean, ideally, and that's our internal sort of ideal world, like difficult conversations. I'd love to be able to just like get along with this person or this other country and not have to have conflict. But then the question becomes like, okay, is that possible? And it really depends on your own values and understanding your own values and what is important to you and what you have control over or not. Now, a lot of what we know about the personal well being and a lot of the neuroscience that we've discussed in this class has been conducted on a really weird people. One of the things that has been called into question in the last ten or 15 years is like, oh, do the conclusions drawn from these scientific studies apply to all people? Or just the kind of like weird people that these studies were conducted on, Like in psychology studies. There's sort of a joke that like, you know, most psychology studies, well, they're just done on students in psychology departments because they're the available population and the brains and the minds of psychology students. Maybe some of you hear at the top institutions say in the United States. Are those representative of human psychology as a whole? Can we say, look at a student from UCLA or Yale who's majoring in psychology. And have them do some little weird task and then draw conclusions that say, ah, well yeah. And that also applies to some random dude living in Sub Saharan Africa. Or someone, you know, some South Pacific islander living in, you know, an indigenous setting. Like does the same psychology apply? And this one guy, Joseph Hendrick, coin this term, weird people. Not just to say that they are weird, it's not a judgment on you, but it's an acronym that stands for Western educated, industrialized, rich, and Democratic. This just describes the cultural context that most scientific studies are conducted in. This doesn't mean that they are wrong, it just might mean that it could limit the strength of the conclusions that you draw about all humans. Oh, this is how all human psychology works. This is how all human brains look. So whether or not you all came from societies like this by virtue of being in Los Angeles in the United States, you're all currently in a society like that. And that is going to be influencing many aspects of what you are thinking about or focusing on as important, or reasonable, or good, or whatever. And so this creates some potential problems. And part of it is because culture is so pervasive that we don't even realize that we are in it. There's a classic example of like two younger fish, you know, swimming through the ocean. An older fish swims by and is like, hey, how's the water today? And then the younger fish are like joking with each other, let's say like what is water? Like, what is he talking about? And so we are so embedded in our culture that we don't even realize the assumptions that the culture has implanted in us. This is one of the benefits of traveling and being exposed to different cultures. As you start to realize like, oh, there's a different way to do things. Like there's a different way to have, you know, a different relationship to work, or to money, or to other people, or to food, or to a lot of different things. And sometimes you can just take a little bit of those things and just bring them back for yourself and just be perfectly happy. Sometimes you're like, oh, I don't like how the culture I'm in is influencing me. I'm going to change that culture. And when I say culture here. There are many cultures that you're embedded in. Because yes, the United States is part of it, but also UCLA. Also a specific job you have. You might realize that the job or the career you have is in a company whose culture is toxic and you don't like how it makes you feel or how it makes you behave towards other people. So you could leave your company, you could leave a team that you don't like, you could leave your country. But you need to first become aware of its effects on you. And whether you, once becoming aware of those effects, would choose something different. So part of the problem is that it's so pervasive we don't even realize its influence. Part of the problem is that people who fall into these categories of weird people, and I would say all of us here would fall into those categories. We only make up about 7% of the world's population. It's helpful to realize like, oh, that's where most of the scientific funding comes from, that's who's doing most of the science. But does this actually apply to the rest of the world? And one of my favorite examples from this book, I read this book. It's very enjoyable and it's really interesting to learn about one of the things that he talks about is literacy and how reading changes the brain, even just the fact that you learn to read and that we agree that you should read. Reading changes your brain to be more analytical and we generally agree, yeah, well that's a good thing, you should do that, and that's why we teach people to read. But if you were living in a forest or you're living as a hunter gatherer, that analytical shift in your brain might make it actually harder to adapt and survive in that environment. Another one of the things that I thought was really fascinating from this book was like just sort of a question about whether you should marry your cousin. Which I think in the US we kind of say is a joke, like, oh, you probably married your cousin. Like obviously, like you wouldn't want to marry your cousin, you shouldn't marry your cousin. I'm not saying that, I'm just saying that's the cultural assumption that this is a bad thing to do. But I think around like 60 or 70% of people in the world do not share that same belief. Like yeah, your cousin would be perfectly fine person to marry. Like, you know, they have good genes and you know, they share the same values. And it's just helpful to sometimes remember that, that the human experience is vast. And the things that you take for just inherently true, or automatic or ridiculous could be the opposite of what someone else believes. And going back to what we're talking about, difficult conversations, you can always feel free to pat yourself on the back at your superiority. And either your intellectual superiority, moral superiority to someone else, and you can feel free to do that. The only issue is that, oh, well, we live in a world with all these people and you feeling superior and convinced of your, your own certainty of how right you are does make you feel better. But it might potentially lead to conflicts because other people might also believe the same way. And if you are fine with the consequences of the conflict, okay sure. Keep patting yourself in the back. But sometimes all we need to do is just acknowledge the fact that you are not 100% right about everything. This is not just good for difficult conversations or for connecting with people who are different from you. This is also essentially the same thing that we learn in science. Yeah, it's great to have your hypothesis and be confident, and you need to be confident enough to take action and invest in a big experiment. But just like, don't assume that even if the data supports your hypothesis, that you are 100% right about everything. Because as soon as you assume that you're one hundre percent right about everything, it eliminates your ability to be curious and explore, which is a fundamental foundation of science. When looking at cultures across the world, scientists have generally group them into two main types. Again, it's helpful to realize the world is vast and complex. Individuals are vast and complex. In order to understand these things, we sometimes have to simplify them into theories. That's why we can say, oh, there are five different personality types or these different types of races. Or there are smart people and they are dumb people, like we classify things. Or you have this blood pressure, ah, you have this elevated risk of heart disease or whatever. We classify things and label things and name things in order to make sense of a very complex world because well, you know, everybody is different and every day is different and whatever. Ah, but there are certain, maybe themes that you can identify that might be meaningful and that's what science attempts to do. It's just like, okay, are there some slight simplifications that we can make about the complexity of reality that would tell us something useful or make useful predictions. But it's always important to recognize that when you're talking about a theory or a grouping, that, that is a useful description of reality. That is a simplification of some much more complex thing. As long as you realize, oh right, this is a simplification, okay, then you're going to be fine. It's when you're like, no, but this is how it is, then that's when it creates a problem. So these are just some observations about two types of societies that share some similar qualities and make predictions that might be useful. The two main types are individualist cultures and collectivist cultures. Individualist cultures value independence. The ability to choose my own path in life, that I should be able to make my own choices or have control. The United States and most countries in Europe are great examples of this. Collectivist cultures vale cooperation with each other, either towards the family, or to the group, or to the community, or to the whole nation. A lot of Eastern culture are sort of better examples of this. Where everyone is sort of like, yeah, we should, I should subsume my own individual needs to the group. Part of the reason Israel is listed in here is like these are the cultural assumptions on a lot of kibbutz, Okay. Well, there's sort of like very communists in their organization that. Okay. Right. I don't want to plant and farm or whatever like, okay? But like, it doesn't matter what I want. It matters like what's going to be best for the group? Should we value my own individual personal happiness and what I feel like doing? Or should we value social harmony and the needs of the group? And individualist cultures sort of place the emphasis on like, yes, you should value the individual subjective well being. Collectivist cultures place an emphasis on valuing social harmony. And interestingly, when we look at attachment styles, the way that parents connect with their children across these different cultures, we see some patterns in general, on average places are good at C attachment or promoting secure attachment, which we know is really helpful for the well being of the child. For one different cultures may differ in their ability to create secure attachment, but that maybe less of a problem in more collectivist cultures. In individualist cultures like the United States, it's super crucial that you have a really close bond with your parents. Because you are raised by your parents. And we were raised in individualist ways, in collectivist cultures, we're like, yeah, you have your parents and your aunts and uncles and everyone your cousins like, well, it's less problematic if you don't have that secure attachment with anyone. And so, ah, so maybe they're less good at promoting it, but it's not a problem. So some of the problems, by the way, for some of you and I've talked to a lot of students about this, like if your parents were raised in one culture, then all of their Tendencies and automatic reactions are going to be calibrated for succeeding and being happy in that culture. And now if they have moved to this culture, you are unfortunately the one who has to bear the brunt of that distinction because they're like what? Obviously we should treat you this way because that's how you succeed. But that might not match up with the culture that you are currently in. Yeah, Western culture. Eastern, What do you mean Eastern cultures? Why is there this difference between Eastern and Western cultures? That is a more complicated question that I don't think really a clear answer to that we don't have time to get into. This is just a description that, oh, there are types. We can see that there are individualist cultures and collectivist cultures, both at the country level, also within a company. Some companies are more cutthroat, some are more like, hey, let's all get along. It also seems to be that Eastern cultures fall more into this category of collectivist, and European and Western cultures are more individualist. Why that is the case, I don't know. I mean, but certainly religion probably plays a role. History plays a role. If you ever book guns, germs, and steel, that might explain things. But even things we'll talk about, about Buddhism, oh, if the religion that you have promotes a certain experience about emotions, how you should relate to them, then that's going to influence your relationships with other people and whatever. Yes, I don't really have a good answer for that, but it's a great question. Oftentimes the best questions don't have the simplest answers. Uh, the other thing that we see is that because different cultures value different things, individualist cultures are more likely to create certain types of attachment because, yes, they maybe all want secure attachment. But if a kid happens to just be a little bit more independent and not nag their parents so much and just sort of keep a stiff upper lip and just go on about their business. That's not the worst thing if you're in an individualist culture. And so a lot of these hoop individualist cultures like Germany, Great Britain, well, the likelihood that you're going to be insecure avoidant, I, E by fine, on your own, is way higher than your likelihood of being insecure resistant where you're much more clingy. Whereas, if you're in a more collectivist culture like Japan, where you shouldn't be totally independent, you should be more interdependent. Yeah, it's not a bad thing if the baby is constantly clinging to the parent and not wanting to leave their side. They shouldn't, they should be dependent on this. And so the cultures can shape the likelihood of how that attachment forms. This is an interesting study that illustrates some of what's happening in the brain. They took Native Chinese and Western participants and gave them some adjectives like smart, or happy, or fun, or whatever in various conditions. In this FMRI study, they asked them to think about whether that trait described themselves or in another condition, whether it applied to their mother, to some other stranger or person in that society. What they found is that regardless of whether someone came from Chinese culture or Western culture, there wassimilar medial prefrontal cortex activity when comparing yourself versus another, a stranger, some random person. So if you're like, hey, are you smart? Are you happy, Are you kind? Well, we have to use this theory of mind system to differentiate between ourselves and how we feel, what we might be thinking for some other random person, because that's a really crucial distinction to make.But there was differential activity in the medial prefrontal cortex when comparing the self versus your mother. Because in individualist cultures, to think about, well, the word happy, well, it matters whether I'm happy or she's happy. I have to be able to make that distinction in my mind, and it matters like Well, yeah, my mom might be happy but I'm not happy. My mom wants me to be a Dr. but I don't want to be a Dr. Like we have to make these distinctions because how I feel about something is crucially important. But in the Chinese culture, there is no significant differential activity on average between when thinking about yourself versus your mother. Why would that be the case? Well, if you think about it, that if you're crucially connected to your mother and your happiness is dependent on your mother's happiness, then it kind of doesn't matter. It's an irrelevant distinction to make whether I am happy, whether my mother is happy, because if my mother's happy then I'm happy. Or if I'm happy that my mother's happy like, and it all just works out. So our brains don't need to make that distinction and therefore it doesn't activate the same brain regions. And that's because if you believe I cannot be happy unless there is harmony within my family, then it's more likely that you came from a collectivist culture. The behaviors like social dominance. Yeah. Correct. Correct. So when you're comparing the self versus another random person, whether you are from a Western culture or this Chinese culture, the brain activity looked the same. That the medial prefrontal cortex did make this distinction between whether it was me or some other random person. When it came to comparing me versus my mother. However, the Chinese participants brains on average, did not make a distinction there. And that's why there's no differential activity in the medial prefrontal cortex. Whereas in the Western cult participants, well it activates a lot differently when I'm thinking about myself versus some other person. Sure, it also plays a role in our behaviors. This FMI study was looked at American versus Japanese participants. And in America, our culture tends to value dominance and being assertive. And in Japan, they tend to value harmony and respect for authority and subordination as a value, as a good thing to do. And so they showed participants silhouettes of bodies, either displaying a dominant posture or a submissive, or Japanese people we call respectful posture. What they found is that culturally congruent postures activated both these reward circuits and the nucleus acumbens, stratum and increase activity in the medial prefrontal cortex. It's just that, you know, which the culturally congruent posture was, was different. So when Americans were looking at someone like being aggressive and assertive was like, oh yeah, because that's what you should be, you should stand up for yourself. You should be independent. And that is rewarding to look at, oh, someone standing up for themselves. It also helps us understand what the other person is thinking. He's like, oh right, like I, I can totally get why they would be standing up for themselves. I can understand their perspective, whereas the Japanese people had the opposite. They saw this person being, you know, respectful and deferential to authority. And they're like, oh yes, that was the pleasing aspect, that was the rewarding aspect. And also, oh, I can totally understand, I can see their perspective and why they would be behaving that way. And it was different when you were looking at the incongruent behavior. The culture also influences, and this is sort of related to, as was mentioned earlier, about Buddhism, about how they value the expression of our emotions differently. In this particular study, we're looking at this notion that Chinese people tend to value like we all like positive emotions. But the Chinese people in the study tend to value this notion of calmness and serenity as being more important than like exuberant, joyful. You know, just look at a beer commercial like in the United States were like, yeah, it's nice to be calm and serene but also, yeah, like rock out and be excited and that's a different way that we choose to value or express those positive emotions. And in this particular study, subjects were asked to rate their ideal expression of their emotions. Pictures represented either the high arousal like, yeah, rock gone America Yeah. Or the low arousal of like, oh, it's just so pleasant out right now, like they're both positive emotions, but how you express them might be different. And what they found is that the Chinese people had on average, greater nucleus accumbens differential response, the low arousal positive effect when they showed the Americans of European descent. These excited emotions versus like calm chill, peaceful emotions. There was no differential activity in the nucleus incumbents, meaning the nucleus comuons looked at that and it was like, oh, that looks great. Oh, that looks great too. Oh, awesome. So we don't see any differential activation. But in the Chinese participants, when we looked at the difference of how it activated between excited minus calm, we saw a decrease in activity. There's a differential activation. And if you just use simple math, that's because the nucleus decumans is activating to this calm state like oh yeah, that looks fantastic, versus the excited state of like, ooh, that seems a little manic. I wouldn't want to express my emotions in that way. And that's why just when we compare it this way, excited minus calm, we see there's a negative aspect. It simply means that their brains responded significantly more. Nucleus responded significantly more to this positive state as opposed to the excited positive state. Whereas the Americans, their brains treated, the European Americans treated those the same. Does that make sense? Cool. So this picture, actually, it took me a long time to find the specifics that I was looking for in this picture. Is anyone if you were sitting around at your house, is there anything that seems odd to you about this picture that you would do things differently or something seems kind of gross or weird about how you would be at your house on Yeah. Arms are crossed. Oh yeah. So that's it, right? Cultural posture. Yeah. Yeah. So that was exactly what I was going for in this picture as well. Like finding a picture of people wearing shoes in the house, it was like a weird thing to search for. Yes. Like so what she said is she usually wears bedroom slippers in the house and these people are just wearing their regular shoes. And some people that's, you know, a family preference. Some people it's not just their family, it's a cultural choice. It's disgusting to take your shoes that you've been walking everywhere and just like walk all over your house. Like it's not simply just like, oh, it's nice to keep, you know, we like it this way. Some cultures place a value on that, as it's disgusting to wear your shoes in the house and then you should take them off immediately. And I just wanted to transition into this, um, recognition that cultures are disgusted by different things. Some of them are actions, a lot of them are foods. Whether this looks delicious or disgusting probably depends on, you know, whether you are kosher or whether you eat beef. Whether you eat your religion or your culture allows you to eat pork or not. This is fermented horse milk which very common in Mongolia. Like you can notice your own emotional reaction to that. Does that sound appealing or does that sound like kind of disgusting? If it sounds kind of disgusting then they were probably not raised in Mongolia or other. I'm not sure if this is Ukraine or I'm not sure what that language is. But there's, you know, you could get horse milk or Coke milk. There's all different kinds of things. Some people might be disgusted by cow's milk that we drink. Here's a delicious looking Mexican dish called Eskimole, which are fried ant eggs. And some might not, that might make your stomach feel a little uncomfortable, the idea of eating ant eggs. Whereas other people say, oh, that sounds delicious. Whether you would eat organ meats like intestines, or liver, or lungs, or the brain. Whether you would eat locusts or other insects, that's going to be influenced by the culture that you grew up in. What is a delicacy versus what is? Well, all cultures have delicacies and things that are disgusting. It's just that what those specific things are, are different. This steak might look delicious if you eat meat, and if you're in a vegetarian culture, it might disgusting. Even if you do eat meat, you might find it less appealing. If you found out that that was actually horse meat, it was difficult. I found this is a picture of horsemat difficult to find on the Internet. Some cultures have a problem with eating dogs. Other cultures don't have a problem with eating dogs. The point is that different cultures make different choices or emphasize different things. But one key aspect is to recognize that the feeling of disgust is a basic human emotion that is recognized across all cultures. You can show facial expressions or sounds of disgust. People recognize it across all different cultures. Like that is a universal human emotion. But the specific foods or behaviors that trigger that disgust are wildly different. In fact, some things that some cultures find, you know, delicious or, or a delicacy are looked at was discussed by other cultures and it's just helpful to realize like, okay, great, whatever, you know, one man's trash is another man's treasure. As the old saying goes, you know, you might love peanut butter and jelly sandwich. It takes you back to childhood. But if you grew up and if you, you know, try and give a peanut butter sandwich to a European and what is this? And it's just unfortunate because they have Natella and they grew up in with nattel. And it seems unfair because we like Natella too. Anyway, rant over. But the point is that things that you think are totally normal, or even delicious could be viewed at, with disgust by another culture. And so the things that you find disgusting feel so immediate and obvious to you. But again, if you just realize that you're not 100% right about everything, you could be correct that you are disgusted by it, but that it does not make it disgusting to everyone. Uh, and you may have guessed, as I was describing, like, oh, does that make your stomach feel weird? That one of the main brain regions responsible in processing disgust is the insula. Because that's paying attention to our internal organs and like, oh, does that make my stomach feel queasy? But there are different kinds of disgust as well. Three key ones that sort of have been identified. One is core disgust, which is things that we would all sort of find inherently disgusting. I don't know if that's the best word for it, but food that has gone rancid, infected wounds, human feces, I don't mean to create a sense of disgust in the core. Discuss refers to the thing itself is like we just find disgusting. That's in contrast with social disgust, which is your sensitivity to other people's expressions of disgust. So even the specific foods that we find disgusting might be different across cultures, but it's about like you try something, oh, that's disgusting. The social disgust is like somebody else taking a bite of food and going, oh, how would you feel? Well, then you taking a bite right after them. Oh, you try this, it's disgusting. Try like the sensitivity to other people's disgust is called social disgust. That's part of the mirror neuron system. It evolved to keep us safe, right? Like if you're in a tribe and you're sitting around and someone takes the first bite of something, like, well, food's probably gone bad, you're not going to want to be excited to eat that. And then there's moral disgust, which is the sensitivity to ethical violations. Now, different cultures have different ethical values, and what counts as an ethical violation is different. But we all have some moral code and we see violations of that. It also activates the insula in the same or similar process of disgust, so all three of those activate the insula, but core. Rancid food and social discuss responding to someone else's expression of disgust. Those are mediated more by the orbital frontal cortex and the stratum. So they're related to motivational parts of the brain and these habitual parts of the brain. They increase activity in those areas. But moral disgust, being disgusted at the behavior of someone else, that violates some value that you have. That selectively activates the medial prefrontal cortex. Because in order to say that someone is, you know, stealing money from a church or like stealing candy from a baby or whatever. Part of the reason that makes it disgusting is your trying to understand their motivation behind their behavior. Like if someone tripped and fell on a, on a child, oh, you might be upset, but you wouldn't actually be disgusted at their moral actions because you're like, oh, they didn't intend to do that, that was an accident. Whereas if someone just walked by and just shoved a kid, or kicked a kid like you back, like you'd be outraged because of what you believe their intention to be. And that's why moral disgust utilizes this theory of mind region. I just wanted to take a moment to talk about this concept called Moral Foundations Theory, which was popularized by this guy, Jonathan Height. Which he discovered that when it comes to the values that we have and what we find is disgusting, violations of those moral values are fairly consistent across the political spectrum. So that regardless of whether you're extremely liberal or deeply conservative, we all kind of agree in these sort of core values that we should protect people that are weaker, like protect children. That's the care value that we should have. Value, fairness and cooperation. That these are important key values. If you're on the liberal side of the spectrum, you might view this graph and be like I knew it, I knew we were morally superior. Because you see that there's a slight decrease in these values. That's perfectly reasonable interpretation. But I haven't shown you the whole graph because what he discovered is that there are many values that we have. It's just that on the liberal side of the spectrum, everyone agrees that care and fairness, which are the most important values. But when it comes to making moral decisions where these things are sometimes at competition with each other, and we have to make difficult choices, the liberals always relied on care and fairness. And if you were liberal, you're probably like, yeah, of course, what else is there? But if you're conservative, they actually had more moral considerations. Other things that they were taking into account, including loyalty, loyalty to your family, loyalty to your community, respect for authority, sanctity, which is the belief that certain things are holy, that we want to avoid contamination. He added this other one later of this value of liberty as opposed to oppression. And when ideally we wouldn't have to make tough choices. But I think it's crucially important that everyone agrees that care and fairness is the important things. But just on the conservative side of the spectrum, they are also taking into account these other moral values which they hold crucially important. Which the liberals are like. That's dumb, why you care about respect for authority, you shouldn't. But there's differences in cultures, and probably within your own families or within your own cultures. Whether or not it applies to this liberal spectrum is like, yeah, different people have, you should just respect your parents just because that's what you should do. And other people are like, that's crazy. But the important thing here is not to say that whatever you're thinking is wrong or the other side is wrong. But simply like, oh, you have a cultural perspective, you don't need to step outside of your cultural perspective. It's just first recognize that you have it and then it influences a lot of your choices and beliefs. There's some interesting neuroscience about this, which showed that when we look at the interior cortex, that there was a differential in volume between liberals and conservatives. That liberals, on average, had a larger interior singular cortex. And this is part of the brain that deals with conflict and competing viewpoints and emotions. And so one explanation is that, oh, part of the reason why conservatives prefer simpler direct explanations is because their brains don't deal with conflict and competing emotions in the same way. And liberals are always like, oh, well, it's complicated. There's always on the one hand, this on the one hand is this. Because their brains are better at processing those things. Whether you interpreting that as a good thing or a bad thing probably depends on your cultural perspective. They also found that conservatives had a bigger amygdala, and you could interpret that as like, oh, they see more things as threats. And in a world where you're more responsive to threats because, and you see the world's a more dangerous place, then often the safer thing is a lot of the choices that conservatives make like right, you don't know what strangers are going to do. You should value and be loyal to your family, for example, or to tradition, or to authority. And it is really helpful sometimes to recognize like, oh, you're judging someone else, you're just overreacting. Maybe they are actually reacting appropriately to the level of threats that they perceive. So just because you do not perceive that threat in the same way it is unhelpful to judge or criticize other people for perceiving threats. Instead, it's much more useful to understand them B, to convince them to be curious about what it is they perceive as a threat. This is important, um, also in empathy and understanding each other. People in this particular study were more accurate at, I should say this is more theory of mind than empathy. Mind reading people of their own culture, trying to understand what is this person thinking? What could they be feeling from a cognitive, trying to understand what they are feeling. We are better at understanding whether someone might be irritated or worried, or friendly. If that person looks more similar to us, that's not naturally something you can change other than perhaps expose yourself to other people who look more differently from you. But it is something to notice that you might automatically be more easily judging people who look like you. Oh, they're scared. Where someone who doesn't look like you might be like, oh, they're angry. And that's crucially important because we live in a multicultural society where there are lots of different kinds of people. This also plays a role not just in theory of mind and understanding what someone else might be thinking, but also in empathy and how we emotionally respond. This Amfam Eri study looked at viewing and painful stimuli for someone of your own race. One of another race. They took white Americans and black Americans. And they showed them pictures of white hands or black hands being poked with a painful needle or with a Q tip As a control. They found that people had decreased empathy related brain activity for other races. That when you saw a hand getting jabbed with a sharp needle, that your automatic mirror neuron system empathic response to that and say the insula was greater than when you saw someone of another race. And when they asked people to fill out measures of implicit bias, they found that the degree to which your insula reacted to someone else's race versus the differential between someone else's race and your race was predicted. By how much implicit bias you had. So some people had very low implicit bias and their brains responded kind of equally, didn't matter the race of the hand. Whereas some people had very strong implicit bias and their brains reacted a lot more differentially to their own race versus the other. And some of this you can't naturally change about yourself, but you can notice it. And sometimes we're saying, well, I can't take action, or I can't think about this more because I don't feel it. But then you're just at the mercy of your feelings, which are at the mercy which is influenced by history and culture. And so even if you don't automatically feel that empathy, you can become aware of your own inherent biases and decide whether you want to take that into the calculation of your actions going forward. And this is crucially important to recognize because, you know, race is a social contract. There's not genetic tests we can have for race. It's just helpful to be was like, oh, am I being influenced and just automatically having less empathy for this person that would otherwise because of this social construct that I have. So in the last few minutes, I only have a 3 minutes or so, but I just wanted to share this experience about sort of how I came into this whole field in the first place. Or at least came to write a book about it. And it connects back to what I mentioned in the first class about how I love ultimate frisbee. And I invited you guys all to try out for the ultimate frisbe team because I started coaching the UCLA women's ultimate frisbee team. You don't have to take notes on this part. Back in 2003, when I was just working at the Brain Mapping Center here and it was the most wonderful or one of the most wonderful, fun things I've ever done, and you still do. I demoted myself to assistant coach Super fun, even though digital cameras wearing as good back down as I am at the bottom of the pile. But unfortunately, this isn't a happy story. And it centers around one girl named Mandy, who back in 2003, she was a freshman. She had a great sense of humor, but maybe I'd just say that because she laughed at all of my lame jokes, but she loved making other people laugh and she had a lot of friends and she was fun and outgoing and she was super athletic and she picked up ultimate really fast. Though I was a bit confused by her because she seemed to really like the team. But then sometimes she would just like ghost to everyone. And then she would come back a few days later. Oh, sorry, I was sick, U. Or she would be running hard to practice. And then at the end, when we were scrimmage and going to do the fun stuff, she was like, oh, oh, can I just sit this out? I'm feeling sick And I was like, she doesn't seem sick. She was just sprinting all over the place And it wasn't until several months later where she revealed what she was really going through that when she said she was sick, it was just her way of describing the depression that she was experiencing. And it really made me rethink depression as like I used to think of it as, oh, it's something that happens to you when bad stuff happens to you. But you can have a wonderful life and wonderful friends and still get stuck. And she recognized the value of being part of the team and playing ultimate frisbee and how great that was for her. And she was getting treatment. Unfortunately though, her condition, she'd been depressed for years and the treatments didn't work. And she, in the fall of her sophomore year, she got more and more depressed. She started to isolate more and she ultimately took her own life. It was tragic and it still, you know, makes me sad and angry. Not at her, just the angry that there's not some better way to help people like this. And that is what propelled me to go to grad school so that I could one day help people like her. And this is why I find it so crucially important to teach all of you about science, to not just learn about this stuff, but to actually apply it to your own lives. To help the people around you to use your understanding that this is all about finding the right balance between the analytical prefunctal cortex and the Olympic system and the stritum for your unique brain. And that just simple changes that you can make in your mindset and your behavior causes all of these positive brain changes that we've been talking about through this whole quarter. And there's so many to choose from, so that even if you feel stuck, there's not just one thing you can do, there's so many different things you can do. And as to remind you of this quote that I talked about in the first lesson, the lecture that they're all interconnected so you don't need to change everything. Like, as soon as you start to make one little change, going to start to reverberate throughout your brain. So I hope you have gained a lot of powerful tools throughout the course of this class and how to use science to actually improve your own life and well being. And as you try to make some of these changes, I recognize it's can be difficult. It's not always automatic, but it can be a choice. And by continuing to choose those things, you start to rewire your brain and make those choices more automatic in the future. So while it may be difficult, the path is always there for you to create an upward spiral in whatever context you are in. Thank you, I apprec

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Okay, cool. So I just wanted to talk about the four different types of childhood attachment. Secure attachment is the most common, and these are all defined by how children react in this strange situation. Was it that tape? Because I remember the image of the table. Yeah, The strange situation is classically like the mother and the child go into a room with some toys. At some point the stranger comes in, then the mother leaves, then the mother comes back. That's the strange situation. How the child reacts during all of that indicates. Are they more secure attachment, are these different kinds? Secure attachment is the most common and the best for the development of the child. What that's characterized by is first when the child goes in the room with the mother, the child explores a lot. It's called secure attachment because the child feels safe and secure with the mother, which helps it feel safe exploring new things. Another key part is when the other stranger comes in, like the baby doesn't know how to react. It looks to the reassured, if the mom is like nervous, then the baby is going to crawl back to mom. If the moms like, oh, it's okay okay, then the baby feels they use their mother as like a guidance to like you should approach someone. The word scaffold isn't the right word, but there's a classic word for it. I can't remember the baby, a stable base from which to explore. If you feel like, oh, I always know I can always go back to the mother to comfort me. And you feel much more comfortable about exploring. But it's crucially, the baby is like checking, anytime it's uncertain, check back with the mother to make sure it's okay. Can I play with this toy? Is this person okay? And then it is reassured. When the mother leaves, the baby is upset. If the baby's not upset when the baby, when the mother leaves, you could interpret that as a calm baby. A good baby like no, like the baby is supposed to be upset when it's attachment figure leaves. It's just that when that attachment figure comes back, the baby should be able to be comforted. It's like happy to see this still upset. Like able to be calmed down. Like the structure for what secure attachment looks like. Insecure resistant. I think everything else either secure, secure attachment distinction. Then there's other types of the distinctions of not secure attachment. There's insecure resistant, which in all forms of not secure attachment or insecure attachment, the baby isn't as exploratory as with secure attachment because even if it is dealing with a dishonest, own it as exploratory when secure, they explore when the mom is present. Yeah. And the exploration stops like like the expiration doesn't stop, but they, they show a reaction of upsetness when the mother leaves. Right. Okay. But they're, they're more predisposed to explore point. It's very, it's akin to what we were talking about, the rat and mouse like licking, like there's a new side of the cage to explore. And if the mother licks their baby a lot, then the baby feels they can explore our lens that we interpret that through. We're like, oh, that's because that's a good mother and they have a good secure attachment. It's good for the baby to explore if things are actually safe in our part of the world, in places where most people grew up, you know like it's generally safe. It's advantageous to be confident, secure, and explore. But my example with the mice or whatever it is like, well, if there's lots of cats around, like, no, you don't want the baby wandering and exploring. But anyway, that's how secure attachment is, insecure. Resistant is they are not exploring as much in the beginning even if the mother is like, yeah, yeah, it's fine, go explore. Like, they're still a little bit cautious when the stranger comes in, they look to the mother for reassurance. Or they might just like crawl back to the mother even if the mother is like, no, no, no, it's okay. Like she's like, they're much more hesitant to keep exploring. When the mother leaves, they are obviously very upset. But the two things that characterize it, that differ from secure attachment are, in the beginning, they're not quite as exploratory, particularly when the stranger comes in. And then the second thing is when the mother comes back, they resist being calmed down. They're upset. Yes, they're glad the mother is back, but they're so upset because now they essentially, they were always worried that the mother would abandon them and not be a secure form of attachment when the mother left, that confirmed that the mother can't isn't fully safe and therefore they desperately want the mother, but the mother isn't fully effective. You could say getting them to calm down or the relationship or the trust that the baby has, the mother isn't secure enough to get them to feel safe. Okay. That makes sense. Relationship is kind of weaker attachment between the mom and child in the second, right? So you can, it's not a shell, even weaker. It's hard to not use like judgmental language but like weaker. The problem with that is in some ways they're stronger relationship, like they are more. Can they need that? I understand that significantly because they don't get enough of whatever reassurance that they need. And it could be something that the parent is doing and maybe it's because the parent is stressed themselves and the baby therefore can't be cow. Maybe it's, they're not responding to the baby in the right way, or maybe the baby is just genetically predisposition towards that or whatever. Just levels of reassurance that the parents offer to the child. And that's characterized by a lot of different things. Sorry, say that again. Like scenario differences is based on the reassurance provided to the child by the mother. And that's right, it's the reassurance. But the point about this is a description of the relationship that the baby perceives with the mother. Okay? It's a, and they may not be based on the actual behavior of the mother or whatever. Like it's just like this is how the baby is behaving. And so we can try and guess, like we can infer what the baby might be thinking. So some of this is my description of the baby might be thinking, but it's essentially the baby does not see the mother as, it sees the mother as a source of safety but not fully effective. Okay, down. So in a sense it is more like addictive qualities like if, you know you see food as a source of safety or alcohol as a source of, it calms you down, but it doesn't really solve the problem. And so then you just need more of it. And there's a lot more anxiety or stress about the relationship. And that's part of why they don't explore as much. Insecure avoidant is behaviorally the baby also doesn't explore as much as secure attachment, but they don't check in with the mother as much. They maybe off playing with the toys, but when the stranger comes in, they're not like looking to the mother for reassurance. Because they might be wary of the stranger, but they realize I need to do this on my own, and therefore, when the key fact there is that when the mother leaves, the child isn't particularly upset and isn't particularly excited to see her when she comes back. Because in both insecure resistant and insecure avoidant, the child gets that or the relationship with the mother isn't fully able to calm them down. In insecure resistant, the baby's reaction is like Oh my God, this isn't fully working. I need to get more of the mother, and it's not quite working. Okay? But that's the baby's attempts to accomplish it, as opposed to insecure avoidant. The baby is like, oh, the mother isn't fully giving me everything I need, Okay? I'll just try and figure it out myself. But the overall thing that ways we describe attachment as insecure only problematic really in the extreme. Oh, there's different variations and everyone looks the same, but you're thinking back to your own child, that's only problematic. In the extreme, disorganized attachment is the fourth kind. And that's much more rare because in the first three insecure resistant, insecure avoidant, the baby has a consistent way of what it believes about the mother relating to the mother in secure attachment. The baby believes the mother is a stable way to calm me down. The other two forms is like, oh, the mother isn't fully a stable way, calm you down, and it makes a choice as to which path it goes in disorganized attachment. The behaviors that the baby does during the strange situation aren't clearly organized around a consistent belief. And so that's why it's organized rhyme or rhythm to what calms them down, right? It's not like they don't follow one of those patterns consistently that I just described. Okay. The reasoning behind that comes from, well, disorganized attachment is often a result when the parent themselves is very inconsistent, either because they are an alcoholic or they have bipolar disorder, or a violent temper or something. And sometimes they are loving and warm and whatever other times they're depressed or something sets them off or they're violent, they're psychotic or whatever. The baby doesn't know how to respond if it thinks it can be reassured because the parent is being really nice. You don't know like oh, is that like about to switch? That creates a lot of anxiety because the baby doesn't know how to feel or how to respond about the mother. Those are the most problematic cases, because at least in the other forms of insecure attachment, the baby has a consistent view of the mother. It's therefore easy, okay? It knows what to do, where disorganized, there's not the predictability, and that creates the most anxiety and problems. Well, thank you so much for that. I have other questions but they can asks first because I don't want to wait. Sure. Yeah. We were just talking about I'll let you guys know about different types of childhood attachment. I'm recording this just in case you guys want to go back and listen to that, but yeah. Sophia looked like your question. Well, that was very interesting. I like that you're talking about this because like a review of things I've heard from lecture before, but I want to ask about some of the miscellaneous like subjects that were actually covered in the lecture. I was really interested in like the sleep hygiene and stuff. I remember you talked a little bit about like insomnia and how people go to like sleep therapy for like a six week program and it, like fixes, it makes it better. I was wondering if you could talk a little bit more about that and like what goes on in there. Like maybe resources for that. Because I had like some friends that I was talking to about like the lecture. And they're like, that's really interesting but they want to know more. But I didn't know that much more, right? Yeah, so yeah, people are watching that sleep isn't on the final exam, but the answer is like sleep hygiene is just a list of things like you should try and do to fully be treated for insomnia disorder. The simple, straightforward step is okay. We do all of these sleep hygiene things because for most people, that solves the problem. If you go see someone about sleep, or even before you go see someone about sleep, you might as well try doing these things. That's the first thing they're going to say to do. But when you have a sleep disorder, there are more advanced techniques of cognitive behavioral therapy. We need to talk about your beliefs about sleep, because those are often causing anxiety. You wake up in the middle of the night, then a thought pops into your head catastrophizing, oh my God, I'm not going to be able to go back to sleep then I'm going to do a terrible job in the final exam tomorrow on blah blah. And because of that thought process and those habitual thoughts that creates anxiety which makes it harder to go back to sleep, it becomes this downward spiral or self fulfilling issue. Some of treatment for those issues are about noticing your own automatic catastrophic thoughts and reminding yourself, like challenging them in different ways. Like minimizing the consequences like hey, even if I can't fall asleep, I still be basically is effective on the final because I know that one night of bad sleep doesn't affect you that much or you could reassure you, oh, if I just lay here, then I'll probably fall back asleep. Or it's totally normal to wake up in the middle of the night. Because sometimes, like I keep waking up, there's something wrong with like, oh, this is totally normal, it's annoying, I'll go back to sleep. Or sometimes behavioral interventions, like when you wake up in the middle of the night, what do you do? Well, I look at my phone and they start scrolling through Instagram. Okay. Well, don't do that. Instead, here are some breathing techniques or whatever. They are more advanced cognitive behavioral techniques, either in the middle of the night or around bedtime. And sometimes there are other, sometimes medication could be involved. Sometimes a more advanced technique is also called sleep restriction, where if you wake up in the, several times in the middle of the night and have a hard time going back to sleep, the issue becomes that your sleep is like fragmented, it's not as restorative. The solution is actually the opposite of what most people think people are like, oh, I know I'm going to get a terrible night of sleep. Instead of going to bed at midnight, I'm going to go to bed at 11 or ten in an effort to try and get more sleep. But then you're not as tired, so you have a hard time falling asleep. Then because you want to sleep early, you're more likely to wake up and you have poor quality sleep. Sometimes the emphasis is on not increasing the amount of sleep, but just increasing what's called the efficiency of your sleep. To actually get less sleep, but to have it be better quality sleep. If you normally go to bed at midnight and you wake up, it takes you while fall asleep. And then you wake up a few times in middle of night and you end up only getting 6 hours of sleep. The Dr. might say, okay, well now your new bedtime is 02:00 A.M. Still wake up at 08:00 A.M. but you go to bed at 02:00 A.M. and you wake up 08:00 A.M. because you're so much more tired. As a result, you're more likely to sleep for 6 hours straight in, your sleep efficiency has improved. And if you can do that for a few days in a row, then they say, okay, now go to bed at 01:45 and see if you can sleep efficiently. Then you can go to 130. And then you slowly increase the amount because sometimes when something becomes a pattern, then your brain to expect you to wake up and it creates that problem all by itself and you have to break up that pattern. Also, seeking treatment is about identifying if there are other medical factors going on. Because some of the things you know, you don't know, is this a bigger problem or is this a little problem because you don't have enough expertise. And if it seems to be a problem, then only a Dr. can say like, oh, oh yeah, this is really serious because there's this other symptom you have and, or that's really weird or like, oh, that's just common but you can't really know that. Sometimes it's like, well you have allergies and that's causing you to snore and that makes your sleep more problematic or you know. Things. It's just some of these things you can understand easily without much expertise. Some of the things you need to go see a Dr. some of these things are very easy to implement. Some of the things are harder because it's harder to recognize your own patterns and tendencies and negative thoughts and blind spots and things like that. Does that answer the question? Yes. Thank you. That was a really good explanation. I had another question, but I'll wait until we go around again where we can find, like the recording for this office hours. I'll just put it on the places, the lectures. Okay. Perfect. Thank you. Yeah. Mallory, were you next? Yes. So my question kind of has to do with the attachment styles that I came in when you were talking about when I was working on the study guide with oxytocin. How does that play in with the specific, like, discussion of the different attachment styles? Oh yeah. Well, oxytocin is the chemical that's like, you know, most crucially important in attachment. Like when the baby gets physical contact from the parents or even just reassuring looks like, then the baby releases oxytocin which reduces their stress. And that is why they're able to explore more because they're less stressed. In insecure resistant, the baby is very anxious. It's trying to get that oxytocin boost from the mother or from the parent calm down its stress. It's just that it might need a lot more oxytoe because there's so much more stress either because the mother, the parent isn't as good as reassuring the baby, Whatever variety of reasons it's seeking that it wants to be cuddled. It wants to be reassured so that it gets more oxo feels more safe. And it's just a more complex process for a variety of reasons. Insecure, these are all big oversimplifications, but in insecure avoidant attachment, the baby has learned that it's not going to consistently get that oxytocin boost from the mother. And it's realize, okay, if I keep trying basically the way the baby got there is likely that it kept trying to get support from the parent, it hurt itself. And it and it looks to the parents to be picked up or something and the parents like, oh, you'll be fine. The baby oh, have this instinct that like I'm stressed, I want to seek reassurance. Oh, they're not giving it to me. Okay. I just need to suck it up and figure out how to do it on my own. They don't get all of the benefits that come with oxytocin, but at least they're not stressed out as much. Whereas like insecure resistant, well, they get lots of oxytocin, but they're still also very anxious about it the whole time. This play relates a what we talked about in the last lecture about culture. That different cultures would define good babies differently. Like in England, you're like, oh, that baby is so well behaved. Like it's just playing by itself and it's quiet in the corner. Like oh, well, maybe it has secure attachment or maybe it has dismissive avoidance attachment. But those are more likely in those cultures because we're like, yeah, people should be self reliant and they should be able to handle themselves. Whereas in a culture like Japan where it's much more emphasis on social harmony and interdependence. You like, No, the baby shunt, just crawl away from the mother and go explore. No, it should be clingy and nurtured. Like that's what a good baby would do, because the parents have certain beliefs about what a good parent is that changes the way the baby is. And it's a complex interaction because different babies have different responsiveness to oxytocin. And they have different levels of reactivity in their stress response. And the parents have different reactivity in her stress response. You could say be a really good parent in that you really want and are eager to calm your child. You're just not good at it because you have all this anxiety or trauma that you haven't dealt with. Or it could be that you don't care that much about calming your child. But you're just generally a relaxed person. You are good at it because different parents are different and different children are different. The situations are different. Like yeah, maybe you're a great parent, your child would generally be calm. But you live in a really terrible neighborhood and you don't have enough money for food and there's extra stresses and it makes it harder. But so that's why there's a lot of complexity in this. And it's very easy to be judgmental of the parent if, you know, the child doesn't have the sort of, like secure attachment. But yeah, I don't know if Did that explain some of what you're asking? Yeah, No, I feel like that clears it up. I was just trying to kind of like, put those pieces together and I feel like that like, definitely cleared it up. Yeah. Awesome. Any other questions about attachment or anything? You Oh, yeah. Sophia? I mean, I had one that kind of related to this now, but Jasmine can go ahead first. I think you need to ask question a bright about. Oh, no, sorry. I'll just going to ask a question about like where we can see our mid term. So it's not exactly related to attachment. You mean like your score in the mid term or like which questions you got right, which ones we got right or wrong. Just for like reference. Yeah. You can schedule a time with your TA to go through it would be best thing. Like normally I would have said like come to office hours earlier in the quarter and I could go through it with you. If there's time at the end of this maybe we could go through it. No, it's all right. Because the final is technically not cumulative. Right? Well is, but the content mostly will be on the content. Second. Yeah. From the second half. Okay. Yeah. Then I don't want to take up other people's time. Everything is very informative. Thank you. Thanks for asking. Um, yeah. Sophia, did you? Yeah. Like related to this like is there like I know you're saying that like if someone has like, an insecure attachment style, like when they're like growing up, they can still form a secure one, like later in life. Right, right. But part of that is like how would like, sorry, go ahead. Like, you can talk about that too, but like like what is it that like makes like someone who like maybe like had like an insecure attachment style when they were a child to like become a secure, like attachment styled parent and like give that to like their child if like they did as a parent. Okay. Yeah. So you weren't asking about like secure attachment and relationships. Human may become a parent. Yeah. Like how you grew up versus how you raised. If you didn't have a safe thing. I want to change that. It's variety of things. One is like your experiences in adolescence. Because your brain, your brain really has two big periods of neuroplasticity. One is as a baby. Where a young child where the most important goal is to connect with your parents. And that's the evolutionary pressure, because with humans that have these brains that take forever to develop in these complex social networks, evolution couldn't figure out how do we make these things self sufficient, like a horse born, and they just run around and eat grass or whatever the self, the nurse. But babies are much more dependent. Evolution made it a well, that's fine. As long as the baby knows that it just needs the parents for everything. That whenever something is wrong, just cry. And then the parents will fix it. All you need to do is teach the baby to cry. The parents have to figure it out. That's the primary goal for kids, is to get along with their parents until about age ten or so. Because if things aren't okay with your parents, then like that creates a big problem for your survival. Beyond that, in adolescence it switches because in the beginning it's just about survival. Later it's about, well, you're going to have to become an adult. At some point. And be able to find your own food and mate with someone else. And coexist with your peers. And be able to calm yourself and not rely on your parents to do that for you. If you can't accomplish those things, then that's a problem for your adulthood. In adolescence, there's this new renewed period of neuroplasticity where all of a sudden all of your goals shift to actually be ways repelled by your parents. Parents like, well, you should do it this way when you're a kid you're like, oh my God, thank you for telling me I love you so much. And when you're a teenager you're like, stop telling me what to do because it's crucially important for you to figure it out yourself. And your reward system gets tuned to what your peers think about you. Because if you can't figure out how to relate to your peers, then you're not going to be able to succeed as adult, depending on what happens to you as a teenager. That can either make things better for you or worse, like, oh, I didn't have secure attachment with my parents. Oh. But I was able to fit in and feel a sense of belonging, connection with my friends. Okay. That rewires things or the reverse could happen, like oh, your parents love you so much, you have such a wonderful relationship with them. And your parents anticipate all of your needs and give you exactly what you want. Now you're in high school and you can't figure out how to have disagreements with people because your parents always knew exactly what you were thinking and what you needed to say. Then now of a sudden you're isolated and you feel like you can't connect with your peers and that creates problems. That's how things can go from bad to good or good to bad. Bidding on the intermediate aspect of adolescence. There's also like your own self awareness and reflection about your experience. And like, oh, I didn't like when my parents did that. To the extent that I am aware of that and I'm aware of my own emotions. Well, then, just because I'm angry. Oh, my mom used to yell at me, oh, I don't want to do that. I'm going to adjust. So we can learn from our behavior. There's also learning from friends and peers about how parenting can be different either because you see the relationship that your friends have with their parents and you're like, oh, I wish my relationship was more like that or like when you're an adult and your friends have children and you're just talking and you see, oh, when my baby cries I tell them to shut up and like, oh, how's that working out for you or whatever. And all of these things, by the way, are influenced by your culture. What is good to be and what is not good to be. But the easiest thing is that if you had a secure attachment as a child, chances are the ways that you will react automatically are more likely to confer secure attachment in your child. Not a guarantee, but it's more likely the more awareness you have or if you get go to therapy and start to become more aware or rewire some of those things, then even if you didn't have, didn't have the ideal parenting that you want, you could become the parent that you want to be. Particularly in cases of trauma where it's like, oh, more extreme version is not just like, oh, my parents were an ideal, but like, oh, like it really messed me up. Well, that's crucially important to get therapy and treatment for that because it's very hard to solve on your own. Good news is like, oh, well, if you do that well, then you can break the cycle because chances are the reason your parents acted that way is because of their traumatic experience. And that's how trauma can get past generationally through these epigenetic mechanisms like you had this experience as a child. And that changes your oxytocin system and changes your response to stress and conflict. Now when you're an adult and your baby won't do what you want, well then you're just going to automatically feel and think. But we can break that through therapy or a lot of the stuff we've talked about in this class. Yeah, thank you so much. I have to run now but I was so helpful. I really appreciate it. Good night. Sorry. Just a quick question about the default mode network. And kind of like because I understand the correlation with the awe, but like I was wondering if you could just kind of clarify the default mode network because I was just a bit like confused on it. Yeah. And some of it is because it's confusing. Just like I say, that's a joke. But it's helpful also to remember sometimes like, wait, this doesn't really make sense and that's because it doesn't fully make sense. So you're like, okay, like I just I, I didn't trust when I was in grad school that my advisor really got what was going on. Because I saw all of these like disparate research studies about depression, that someone said this and some said that like they didn't really make sense. And I actually went across the street into like a different professor, this woman who's ahead of the anxiety disorders program. And I was like, I felt guilty That was like going behind my advisor's back. But I just wanted to double check. And I was like, well, like this study says this, but this study says the opposite. And this one is confusing and whatever. And like, I don't understand what's going on and she was like, no, it sounds like you have a really good understanding of what's going on. Like oh, it's just that what's going on isn't it doesn't have a neat explanation in this class. The part of the problem is like I'm trying to simplify it to the point where it's, oh, you can understand it and feel like you have a grasp on it. Just remember that it's a simplification and that there's like other stuff that doesn't really make sense and you can't shove everything makes sense in the same way. So that's the first part. The second thing is the default mode network was defined by the set of brain regions that is active by default. Whenever you do any specific task then they decrease. I'm like sitting in MRI, these regions are active. I start doing a gambling task or I start doing a face whatever, those regions decrease in activity. As soon as I stop the task, it come back up. That's why it's called the network there by default, active the rest, the rest of your brain. It just also happens that those same brain regions, that whole network is also involved when you're utilizing your theory of mind or doing social cognition or thinking about things. One interpretation is like your brain is by default processing theory of mind and thinking and reflecting about your own emotions and thinking about other people's emotions and your relationship with other people and all that, like, that's their default state. Which is why if you are really focused on a task and your roommate interrupts you, you're not going to be like, oh, this must be really important for them because they interrupted me. I wonder what's going on? Because your theory of mind system is down regulated. Because you're focused on this task, you're going to react. What are you doing in the middle of the? You're going to see them as an obstacle as opposed to activating your theory of mind. Whereas if you were just sitting there not doing anything and then they came in, you might utilize your theory of mind more. So it's like, I'm trying to remember from lecture. So it's like an idea, like increased self significance almost. And it's like, I don't know if that makes sense. I was just look at my notes briefly, but like so that description of the default mode network in general. And then your question though was specifically about as it relates to a Or about. Yeah, about a, yes. About a sorry. So when we look at a is a complex emotion because it's, it's sort of both activates the sympathetic and parasympathetic nervous system. It's sort of like exciting but also scary but also calming like when you stand by the Grand Canyon. Like well, it's beautiful. I feel small and insignificant. But it turns out that when we look at how, what effect does that have on the default mode network? It decreases activity in the default mode network because when yes, the default mode network, when you're sitting there not doing anything by default active. But if it's really active then you're probably like ruminating about all of these things in these motions or whatever. You're stuck your own head and experiencing a palms down a little bit. You're not like self focused and self absorbed. One of the interpretations for why that's the case is because like, oh, we ruminate when we think of our problems as being really important and really significant by experiencing that star is 4 billion miles away. And that's like the closest one next to the Sun, insignificant. Go. I guess my problems don't matter that much or they're easier to surmount. Yes, it makes you feel small but maybe more connected to every other human who is also small and insignificant. It's like a perspective, almost like reperspective. That's just like we like. There's lots of different reasons. But just based on some of the effects that we see, that it reduces that self focused default mode network activity. It also increases feelings of altruism. That's right, because it makes you feel small and significant. It puts some of those things in perspective and maybe makes you feel connected to all of the people around you. Because they are also small and insignificant and also going through difficult emotional struggles just like you. That makes a lot of sense. I have to go because I have a class at three. But thank you so much for going over my questions and I Yeah, thank you. Have a good one. I also have a class at three. Sorry, I was going to get going, but yeah. Thank you so much. I have a good one. Okay. Every I saw the study guide for the final exam post. See it on Bruin Learn. I believe it should be in let's see, pages. It should be in week ten. Page double check. Yeah, so it's under week ten and it's this final resources AP and final study guide. Let me know if you see that or not to come back to you. But Molly, did you have Yes, I did. I was just was in looking over my lecture notes when we talked about the differences between empathy, validation and sympathy versus compassion. And then you started talking about how each one is involved in theory of mind versus the mirror nervous system, right? Yeah, I mean, that's probably a little confusing. Yeah. Because I have a note from lecture where you had talked about how empathy is involved with like the mirror neuro neuron system, which those separate things. Okay, basically the first thing is about like, these are ways of like relating to other people. Either feeling what they feel or like understanding their perspective and their intentions. Or not feeling them, not understanding them, but still be like, hey, would you like a sandwich? Like yeah and you can, those are just the point was like you do, those are three separate things because there are three circuits. One is feeling, one is thinking, one is action. Yes. What often happens is they work together that oh, I feel bad, which makes me think about someone suffering, which then makes me take action to help them. Part of my point about it though is like because they're separate, sometimes we're like, oh, I don't think about them because I don't feel as much automatic empathy. Okay. You can still think about the L as deeply or even it, you don't really understand why they're suffering. You can still recognize that they are still take action to help them. They are often related in the normal course of things, but they're just separate brain processes. So to sum up that the empathy is feeling someone else's feelings, that's much more the mirror neuron system. You see a person sleeping on the street, or you see someone get mugged, or you see someone in a car accident, whatever it immediately and different people have different levels of empathy or to go to like what we talked about in the last lecture. If you see someone get stabbed with a needle, you automatically feel it. Although how much you feel depends on the color of the skin of the person who is getting. But that's empathy, is that automatic response that's related to the mirror neuron system, like pain related activation is like in the insula and the anterior singular. Just that feeling or validation. Is a theory of mind. Concept is understanding someone else's perspective. Like I wouldn't like it if I was getting poked with a needle. I don't feel as much empathy because I'm really racist or whatever. You can have high racial preference and not be racist like I grew up around. People all looked like me. My empathy system doesn't react as strongly. Okay. But I can still be, oh well they're still a person. So I could cognitively understand, oh, they are in pain, I don't feel it, Okay, that's fine. But then you can either use your lack of automatic empathy as a reason to not take action, or you could say, oh, well, I should take action. And actually, but the theory of mind part of it is trying to understand someone else's perspective and to think about their intentions and their motivations, and how their experiences might be different from yours. Okay. And so yeah, I think about it later, just like when I talk about later, those two pieces were related to like the what and how. Yeah, mirror neuron system is more simply like you see someone and your brain responds. That is part of the empathy system. But it's also like how you imitate behavior. Okay. Whereas the mirror neuron system is about, I'm the theory of mind system about, I wonder why that person is standing on the street corner, they waiting for a friend they lost, not have anywhere to live like I don't like. That's trying to understand why they are doing what they are doing. Okay. Okay. Awesome. Yeah. Because okay, that makes a lot more sense. Compassion is more just like an act that may or may not follow depending on your levels of. Right. Yeah. Those two slides are separate things. Empathy, yes, is most closely connected to the mirror neuron system. But the mirror neuron system, part of it is like I was just making two separate points. Yeah, the mirror neuron system is involved in empathy. It's also involved in imitation. Okay, like if I play five notes on a piano, doing whatever. And then because of your mirror neuron system, you can just repeat and mimic what I just did. And if I disrupt the mirror neurons, then it's harder for you. Whereas if I disrupt the theory of mind system, you don't have to under why I'm playing these notes. You just imitation where mine system would be like. I wonder why is this person playing the piano? Do they want me to imitate them? What it is thinking about it, whereas the mirror neuron system is feeling perceiving it. And that is when we talk specifically about our relationships with other people. Like acting compassionately is a separate thing. Okay, Okay, perfect. Thank you so much. Yeah. You're welcome. Any other questions? I think that was my main when I was just going over it. I'll look over my notes quickly though and Yeah. Sure. I can check in with every every Did you have any particular questions? I'm glad you saw the study guide. No, that was it. Okay, cool. Yeah. I mean, Molly, as long as you know, is there anything you don't have to stick around but like, is there anything like you're wondering about or would like to hear more about? I'm just going to now. It's okay. Okay. Oh, I was interested in I know we didn't get a chance to get to the additional questions portion in Lecture 16, but I was interested in hearing about like the sleep paralysis and insomnia. Just kind of more about that. Like insomnia, I feel like I understand a little bit better. Just more, it just seems more like natural versus sleep paralysis and how that kind of works. Yeah, well, sleep paralysis is actually natural. I mean, very common or common in everyone, depending on how you describe sleep paralysis. So this part is not on the exam, but everyone experiences sleep paralysis or almost everyone. Because what has to happen when you are in rem, sleep or in your dreaming is your brain is replaying all of these things that you did or throughout the day. And you are activating motor parts of the brain which normally, when activated, would move your body. Your brain has to have a function where it disconnects functionally, your brain activity from your body because otherwise you would act out your dreams. There's a where that happens to people. It's called M sleep behavior disorder. The comedian mperbiglias a great movie called Sleepwalk with Me. He has a lot of great standup specials where he talks about this really because his father is a neurologist. But he has behavior disorder which means that like moves and like does the stuff that's in his dreams. And it's really dangerous because you can hurt yourself If he jumped out. The second story of Window of a Kina Washington, that's one of his jokes, but the emerges your room because he fell out of the second story. It can be dangerous to the people you're sleeping with. It's like crucially important that your brain paralyzes your body. If that goes wrong in one way, you could have sleep behavior disorder, but it also go wrong the other way in which you wake up and you can't move. Or like while you're trying to fall asleep like on too soon and you can't really move. It's just a completely normal natural function that could malfunction one way or the other. Sleep walking. Like an understated version of that. Yeah, you could sleep walk and not have sleep behavior disorder. But on the spectrum of those things, if you sleep walk, that should be something you should get evaluated. Yeah, it's much more common in children and things. A lot of times like you get better as you get older. But yeah, it's problem. It's also a problem, like in college students. One of the reasons it becomes a problem, like with heavy drinking, like oh, you're like like because alcohol changes the reactivity of your brain in certain ways. Sometimes that's really problematic. If you have too much and you're taking opioids or some other vice in as well, and then you could disrupt your ability to breathe and sleep at the same time. That's really problematic. But just like large amounts of alcohol itself could disrupt how your brain functions and some people might only do it when they're really run. It can also be more common if you have disrupted sleep. In general, if you've been sleeping poorly or you're really stressed and architecture is disrupted, then that can make it more likely that you sleepwalkotentially. Often the solution is like right, improve your sleep hygiene. Yeah. Your stress or other things like that. Yeah. Okay, That's interesting. Definitely. Okay. Well, thank you so much for your help. Yeah, you're welcome. Great talking with You have a good one. You too. Okay. Yeah. So the question is just clarifying about what the goal of the introduction or a little bit more specifics about the paper. What I told the TA's is, the way I like to think about the paper is it's one big experiment. The thing that ties the experiment together is your outcome variable. Because otherwise it would be, if there wasn't one outcome variable that you were looking, then it would just be like three random things. I did this, and I did this, and I did this. We did collect all of the data from all of the outcome variables and maybe you looked at different ones throughout the quarter. But the point of This is to write about it from the perspective as a cohesive analysis. Like you could write a totally different paper about three different things about a different outcome variable. But essentially it is like, what are your three um, interventions that you're choosing than me personally? Yeah, I'm looking at exercise mindfulness and then journaling which is what I did for my Choose your own right? Yeah. Yeah. So you and what is your outcome variable? I'm looking at calmness and relaxation. Okay. So it is a study of what makes Sadie calm or is like is an investigation into the effects of various interventions on your calmness and relaxation. So that sorry, go ahead. Yeah, that is like the impetus for the study is that you're interested in how to be calmer and more relaxed and what are the various factors that would influence that? Then you would have a paragraph about like, well there's this research that shows that exercise has an impact. You talk about exercise study like these people studied it in adolescent women and found a reduced blah. Then this other study looked at mindfulness in older adults and found that it reduced than this other research about journaling. The experiment is to see which of how those affect your outcome variable and which ones might affect it. More specifically, you might talk a little bit more about your own intervention because that was the one you chose after the other two. You might talk a little bit about why you specifically thought that would affect your calmness more. But that is essentially what the introduction is like. You're just presenting your reasoning for the topic, what you're looking at. You have one paragraph, different interventions and then, you know, your conclusion can be your hypothesis could be that you either at that one of those interventions would work better than the other ones. Are you think that they would have bigger effect on you than on the class? I don't know, but that's what the introduction is that make sense feel like. Make is basically what a the first time t but then when we were in class today, RTA was saying that instead of talking about the other studies that we found that show background evidence about the impact of these various interventions, that we should be talking about our past experiments, like using these interventions like previously when we looked at the impact of exercise as the background information and didn't really get because then he's like, don't make it redundant and I don't understand what that means. Right, Yeah, I guess is the I think he is trying to emphasize like we don't want to just like rewrite everything that you did in the weekly write ups, but clearly you're talking about the same things so there will be some redundancy. But just make it clear that the goal of this isn't to just like recapitulate, like copy and paste right from your other. Studies. But I think you do want to think of this particularly in the introduction section. Would you want to talk more about the background research? I mean, I suppose like, we should clarify with him like there, but like, I think it is really about and I'll, I'll send him an e mail I guess. But it's really about presenting well the research because that has previously been done. Like yes, you kind of have to pretend that you don't know the answer. But theoretically, you should have been able to write the introduction before you did any of the experiments, right? Yeah. You happen to be writing after you did the experiments, but like it should state the rationale behind why you are doing these experiments. Yes. Yes. So then my last question because I have to get into another class at 03:30 But my last question I guess, is that you said earlier that the purpose of this paper, in my case, would basically be about what makes me calm and relaxed. That that would be the question that we're looking to answer. Right? That's the question you are looking today. In our discussion section, I wrote it down as a note because the TA said that having a thesis that is like this intervention is the best, is a bad thesis. What we want instead is that like for example, maybe it text deal and there isn't one side on could lay out B. Sorry you're cutting out it could out, sorry, you're cutting out. I couldn't really hear what you were saying. Can you still hear me? Oh, that's okay. Yeah, I can still hear you. Basically, what I was saying was that, yeah, you said that basically the thesis of the paper is it's a study about what makes me the most calm and relaxed and what are the factors that impact that. Then today in our discussion, the T that talking about what type of intervention would have the largest impact on relaxation would be a bad thesis. Why? Because he said that we should try to take it probably one step further. Like for example, we could say that none of these are good because it's very contextual and there isn't a one size fits all thing like the example that he gave. But I guess this is why I'm having a hard time finishing the introduction because he also said that he wants the thesis to kind of lay out like what we're going to find in the paper pretty clearly about like we're going to look at this and then this and we're hopefully going to find this. I don't really get what he means. I feel really confused. Maybe I'm just missing something. Maybe not understanding something. Yeah, I don't know exactly. I mean, there's like difference ways to describe what you're trying to do. Like there's the more passive way investigate. Like there's evidence about all three of these things. And so I'm just going to investigate their impact on me and compare them to the impact on other students in a college course. That's the sort non hypothesis driven way of stating it, which is perfectly fine in my view, scientifically. But like presumably you should believe that your own intervention is better at affecting your outcome variable. Or like why are doing it right? You have this preconceived like based on your own understanding of yourself and what you've heard and previous research and like that it seems perfectly fine state that you have hypothesis like in the conclusions that you draw in the discussion section. Very reasonable like okay, what he was talking about. That you're like, oh well it's contextual and you can't really know because I only did this one after that one. And this one was during mid terms. And whatever the purpose of this is, to gain at least some awareness about yourself. That like I've always heard that journaling was good for you. Like does it actually help me? And then it does seem to help me. That's interesting, it helps other people's interventions had a bigger impact. They didn't do journaling, but maybe I should figure out what everyone else is doing and do that. But oh, yes, it does have a big impact, but exercise had a bigger impact. If you, mindfulness had a bigger impact. So if I only had 10 minutes to do something, well, then I should probably practice mindfulness instead of journaling. Now you've learned something that you could potentially apply to yourself in the future. But that Okay. Part is in like the discussion section and the conclusions and the limitations. Okay. So I'm just going to do what I was doing at first because I feel like that's more what you are saying. Yeah. Okay. Okay. Things I suppose. Okay. Well, thank you. Thank you so much for answering my questions and hopefully I do the right thing. I need to go to class. Okay. Have a good one. Okay. Okay. Thank you so much, Professor. Welcome. Bye and yeah, hopefully you found some of that helpful. Okay. Have a good one.