Decision-Making and the Shadowy Brain (Part 1) [Transcript]

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I'm a neurobiologist by training, and I tend to think about everything first from a neurobiological perspective. Take the quote “We see the world not as it is, but as we are.” When I came across that quote recently, I immediately thought about a fundamental principle in neurobiology, involving the balance between opposite forces.

the two learning systems in our brains and how part of our brain can actually trick us

Through the course of evolution, there's been an expansion of neocortex in primate brains. And compared to other primates, humans have relatively large brains for our body size, with a lot more neural cells, more connections among neurons, and a generally higher level of complexity and flexibility.

As a result, we excel in higher cognitive processes, including the ability to think critically and creatively, to problem-solve, and to understand the consequences of our actions, even when those consequences aren't immediate.

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These capabilities are due to a great extent to the workings of a portion of the brain known as the prefrontal system, which includes the prefrontal lobes. You are going to be using your prefrontal system a lot to get you to graduation.

Now, thanks to the prefrontal system, the human brain has all the capabilities we need to address any Wicked Problem. The same capabilities, in fact, that created the technology and social systems that got us into this Wicked Problem of Global Change in the first place.

So with our complex, highly-capable brains, why have we had such a hard time accepting the reality of global climate change? And how can a neurobiological perspective on this question help? To explore this, we're going to do a quick dive into the neurobiology of how we decide what to believe and how to behave.

Obviously, our evolutionarily new prefrontal system plays an important role in decision-making. But, and this is critical, it isn't the only brain system involved. When we make a decision, the prefrontal system has to work with -- and sometimes argue with -- the evolutionarily primitive but powerful limbic system.

The limbic system operates in the shadows. It is physically located deep in the brain. And it mostly operates below the level of our conscious awareness. This shadowy nature gives the limbic system some of its power. Because it acts subconsciously, the limbic system can influence your behavior without you ever being aware of it. The limbic system also had to be powerful enough to help our ancestors survive to live another day.

So keep these two players in mind. The prefrontal system, which is newly expanded in humans, and oh so very important to our ability to think beyond the present time and place. And the limbic system, which is something

of the opposite -- evolutionarily older and essential to the short-term survival of the individual, whether that's a human, a wolf, or a mouse. Every decision we make involves these two players, and their influence on our decision reflects what each system has learned.

Surprisingly, the prefrontal system and the limbic system are actually learning different sorts of things. Now, the fact that the prefrontal system and the limbic system can learn different things was revealed by the groundbreaking work of Dr. Brenda Milner, who essentially created the field of cognitive neuroscience, or the neurobiology of how we think.

Based originally on Dr. Milner's insights, we now know that there are two neurobiologically distinct learning systems. One called explicit learning, and the other called implicit learning. Explicit learning is the type of learning and memory that we typically mean when we say "learning and memory." It's about information, facts, events, the sorts of things that we can actively, consciously recall when we need to do so.

We use our fancy new prefrontal system to learn explicitly, and we tend to be consciously aware of this process. If you are trying to learn the different terms I've mentioned, then you are using your explicit learning and your prefrontal system right now.

In contrast, implicit learning mostly just happens. Implicit learning isn't expressed through conscious recall. Instead, what we learn implicitly shows itself through our habits, our sense of familiarity, our preferences and inclinations, our perceptual and motor skills, and some of our emotional reactions.

To use an example from the second part of Dr. Marsha Gordon's talk, explicit learning includes the facts and figures that Dr. Gordon learned from watching documentaries about climate change in elementary school. At the same time, if the documentary she saw in school only showed scientists who were white men with short hair and glasses, the young Dr. Gordon would implicitly learn that only white men with short hair and glasses are scientists. She would learn this without noticing she had learned it, which is why it's called implicit learning. It occurs without any explicit recognition or conscious thought, nestled deeply in the ancient limbic brain.

If you are interested in hearing more examples, you should check out a TED Talk called the Danger of a Single Story, by Chimamanda Ngozi Adichie. She speaks from a storyteller's perspective, and her message really resonates with my neurobiologist’s perspective.

So we have two systems important to making decisions, and each one is learning different things. On the one hand, we've got our complex, thoughtful prefrontal system, which uses what we learn explicitly, and has the ability to think about the remote consequences of our actions. The prefrontal system prioritizes evidence, logic, and reason. And it really does set us apart from other mammals. You wouldn't be in college without the capabilities of the prefrontal system. In fact, colleges wouldn’t exist as we know them.

On the other hand, we've got the shadowy limbic system, operating in our subconscious, and using stuff we didn't necessarily choose to learn but still learned implicitly. Implicit learning in the limbic system was really important in enabling our ancestors to respond quickly without wasting time on thinking, to avoid a predator and survive another day. The limbic system also strongly encourages us to be part of a social group, to fit in -- something that had survival benefits as well.

Now, imagine a scenario in which you need to make a decision that weighs the short-term effects against the long-term effects of that decision. For example, maybe it's deciding whether or not to get a newly created vaccine. There will likely be short-term, flu-like side effects and long-term protection from a deadly virus. If you let your limbic system decide, what would you do? Get the vaccine, or no? And if you let your prefrontal system

decide, would you get the vaccine?

Of course, neither system typically gets to make the decision on its own. And when these two systems are not in agreement, it sets up a bit of a battle. Your decision is ultimately a result of that battle between your prefrontal system and your limbic system. And by the way, when you are overtired or alcohol-impaired, your prefrontal system is at a serious disadvantage in any battle with the limbic system. The limbic system also knows how to cheat. And we'll consider that in the second part of this talk.

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