

# BRAIN SCIENCE PODCAST

*With Ginger Campbell, MD*

## Episode #11

A Discussion of Emotions, Based on the Book *Emotion: The Science of Sentiment*

by Dylan Evans

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## INTRODUCTION

This is the *Brain Science Podcast*—the podcast for everyone who has a brain—and I'm your host Dr. Ginger Campbell. On the *Brain Science Podcast* I explore how recent discoveries in neuroscience are unraveling the mysteries of how our brains make us who we are.

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This is [Episode 11](#) of the *Brain Science Podcast*. Today I'm going to talk about emotions. This is a really fascinating area that I've been wanting to talk about ever since I started the podcast. Two of the pioneers of the neuroscience of emotions are Joseph LeDoux and Antonio Damasio. One of my favorite books on this subject is Antonio Damasio's book, *The Feeling of What Happens*.

Today's discussion is going to be an overview of the subject, and I'm going to be using a book that was suggested to me by one of my listeners, Kate, from the UK. This book is, [Emotion: The Science of Sentiment](#), by Dylan Evans. It was published in 2001 by Oxford University Press. This is the first time I've used a book suggested by a listener, but I certainly encourage you to send in suggestions

about books you think would be good for the show. And even if I don't use them, we can share them with others.

Now, a little bit of background about Evans. Naturally you might expect he is from the UK. He started as a psychoanalyst and worked in the British Health Service. Then he became disillusioned and went to the London School of Economics for graduate work, where he became entranced with evolutionary psychology. The influence of evolutionary psychology is evident in this book, which was based on his 2000 PhD thesis.

In his bio on his website—which I have a link to in the Show Notes—he says that his thesis was a comparison of classical and modern views of emotion. The basic premise of this book is that our emotions are an essential component in our intelligence. Hopefully we will return to the topic in the future and we will probe some of the neuroscience more deeply.

## **DISCUSSION**

The first question I want to consider is, are emotions a universal characteristic of humans or are they culturally determined? Until the 1960's it was assumed that emotions were cultural in origin. But then anthropologist, Paul Ekman, did an extensive study of many different cultures that proved there are several universal innate emotions.

He did this by making pictures of faces and showing them to people. And he determined that there were facial expressions that were cross-cultural and could be recognized by people of all cultures and were seen by people of all cultures. He called these emotions the basic emotions, and these would be the ones that could be recognized by looking at the face of a person from anywhere. Even babies that are born blind make facial expressions that represent these emotions and can be recognized.

The basic emotions are joy, distress, anger, fear, surprise, and disgust. Sometimes they might be called other things, especially if they're being translated into another language. The fact that there are universal basic emotions argues for a biological cause. And of course, we now know that these are the emotions that are rooted in the limbic system of the brain.

Obviously, different cultures have different rules about showing emotions. For example, the Japanese learn very early to be very reserved, and they may not easily show disgust. However, if a video is played back in slow motion you can detect an expression of disgust that appears very briefly, before they suppress it with their learned response.

Beyond the basic emotions there are culturally learned emotions that we acquire in childhood by exposure to our specific culture. It is important to realize that these feel just as real, and they are not fake. A pretty weird example of this is in the Gurumba people of New Guinea they have a state called "being a wild pig;" which is just like it sounds—the person acts like a wild pig. When a person goes into this state they get treated with tolerance. It's kind of like they get a time out. Interestingly, it's mainly experienced by men 25 to 35, and only by those who would benefit, such as those that are in financial difficulty.

Actually innateness is not an all-or-none phenomenon: it's more a question of degree. We should not ask whether something is innate, but how innate it is. For example, learning a language is less innate than growing legs; but learning English is even less innate. Basic emotions are more innate than culturally specific emotions, but they still require minimal conditions for normal development.

Romantic love is an example of an emotion where opinion is mixed on how innate it is and how culturally acquired it is. Philosopher Paul Griffiths has argued that there are actually three kinds of emotions: basic emotions, culturally

specific emotions, and what he calls higher cognitive emotions. The higher cognitive emotions would be less innate than the basic emotions, but more innate than the culturally specific—that is, they would come in between the basic emotions and the culturally specific emotions on the continuum.

How are higher cognitive emotions different from basic emotions? For one thing, they aren't as automatic or as fast, and they aren't associated with a single facial expression. Love seems to be a good example of this, where it usually develops over time, but it is definitely cross-cultural. Also higher cognitive emotions are more capable of being influenced by conscious thought.

It seems that higher cognitive emotions may have evolved for the purpose of coping with social life. Some examples of higher cognitive emotions are love, guilt, shame, embarrassment, pride, envy, and jealousy. I think you would agree that you would see these in any culture, but you wouldn't see them in lower animals—at least not for the most part.

Not surprisingly, basic emotions can be co-opted for social functions, such as when a person feels disgust when they see something they consider immoral. But the basic principle is that there is a continuum from the innate emotions, up through the higher cognitive emotions, to the culturally acquired emotions.

But why are emotions important? Evans argues that Vulcans, like Mr. Spock in *Star Trek*, could not have evolved. He argues that we need our emotions. Until recently there was a pretty negative view of emotions holding sway. Emotions were seen as something that we had to overcome and suppress because they were somehow inferior to logic. That's why in *Star Trek* it's portrayed that if Mr. Spock can be totally logical he will somehow be smarter than the humans around him.

But Evans argues that people without emotions would not have survived. And this is certainly supported by what we see in the brain damaged patients who have emotional deficits. They can't function normally. This has been shown by the recent research by people like Joseph Ledoux and Antonio Damasio, who have shown how essential these emotions actually are.

One of the things Ledoux has shown is that there are two pathways for emotional stimuli. One, the fast, or low road, goes via the sensory thalamus to the amygdala. The sensory thalamus is like the relay station for sensory input before it goes to other parts of the brain. The amygdala is the brain structure associated with emotions like fear. So, for the fast route the stimulus goes straight from the sensory thalamus to the amygdala. The slower, or high road, goes via the sensory thalamus to the sensory cortex and then feeds back to the amygdala.

The easiest way to understand the difference is to think about this example. Imagine that you're walking around in your backyard and you see an object that has a shape like a snake. You might be startled and have a split second of fear, and then you realize that the shape is the garden hose, or a funny-shaped stick, and you don't feel afraid anymore.

So, that initial fear that you experience when you see the snake shape is that fast pathway where the sensory information of the shape went straight to the amygdala. And then when you realize it's not a snake, that's the pathway going through the cortex, which interprets it and figures out what it really is. Another important principle is usually both pathways are involved.

One way that emotions seem to be important is in communication. With our facial expressions we communicate a lot of information to others. But, of course, people aren't the only ones who can deceive. Consider the fact that there are animals who, when they're afraid their hair stands on end and it makes them look

more threatening, so it kind of covers up the fact that they're actually really afraid.

Darwin may have been the first to notice this when he wrote about this in his 1871 book, *The Expression of Emotions in Man and Animals*. Obviously emotions are of great interest to evolutionary psychologists, and sometimes they are accused of putting too much emphasis on the evolutionary origins of emotions and ignoring the cultural aspects.

Joseph Ledoux has also shown that the same neural mechanisms mediate the fear response in all sorts of animals, from birds to mammals. And this fits an important principle that we've talked about before when we were talking about the molecular basis of neuronal activity—how it is preserved across species; like once something is evolved it is highly conserved.

Consider fear in mammals. Fear and anger are mediated by the limbic system. The limbic system is a set of structures deep in the brain, in the center of the brain, that includes the hippocampus, the cingulate gyrus, the anterior thalamus, and the amygdala. These structures are also seen in birds, amphibians, and reptiles. It's the growth of the neocortex that sets mammals apart.

That helps us to understand the reason for the dual pathway that I mentioned before—the fast pathway and the slow pathway—because we have the fast pathway inherited from our most ancient ancestors, and then the higher pathway has evolved more recently. Higher cognitive emotions seem to involve more cortical processing. So, we can begin to see how emotions really do fall on a continuum between the innate basic emotions and the highly cortical culturally specific emotions.

In fact, most of the time any emotion we feel is probably going to be some kind of a mixture between our initial sort of unconscious response and then the cortical

processing. It seems like common sense to say that the optimal state would be the proper amount of emotion for a given situation. I mean if you never get angry you're just going to be a doormat; but you don't want to be flying off the handle. So, Aristotle's Golden Mean starts to look a lot like what today is called emotional intelligence.

Returning to the issue of facial expressions, the evidence now indicates that the ability to judge emotions by interpreting facial expressions is actually subserved by key limbic structures such as the amygdala. We know this because bilateral damage to the amygdala is very disabling. People with this kind of damage lose the ability to judge emotions in facial expressions. Another way to think about the role of facial expressions in communication is think about the difference between the amount of information you get when you're talking with a person face-to-face compared to when you try to communicate by email or even over the phone.

An area that is only recently being appreciated is the role of emotions in moral behavior. Back during the Enlightenment, Adam Smith—he's the same man that wrote *Wealth of Nations*—but his main interest was in the role of emotions in moral behavior. And he thought they were very important. But Western thought has been strongly influenced by Kant, and he thought that morality was a function of pure reason—that we did the right thing through logic.

However, the evidence is mounting that our moral behavior is not based on a logical moral subroutine, but it's mostly based on emotions like sympathy, guilt, and pride. For example, what really motivated you to be good when you were a small child? Did you really have any logical considerations of right and wrong? No; you were just trying to please your parents. That was an emotional motivation. And psychopaths don't lack the ability to apply rules logically; what they lack is normal emotional circuitry.

I was listening to an episode of *All in the Mind*, an Australian podcast, and they were talking about the recent demonstration during an experiment that should stimulate the amygdala, that psychopaths lack normal activity of the amygdala. The experiment is this: People listen to words like ‘table’ and ‘chair,’ and other words that have emotional content, like ‘murder’ and ‘death.’ In normal people the amygdala lights up when words that have emotional content appear, but in the psychopaths the amygdala doesn’t. So, this is a pretty impressive result.

What is the relationship between mood and emotions? This is probably easier to understand if you think of an example. Joy is a basic emotion; it lasts only a few seconds. But a mood, like happiness, is more long-lasting. It’s more of a background state. Damasio also makes a big distinction between emotions and feelings, but I’m not going to be getting into that in this episode.

So, mood is a background state—like happiness, depression, that sort of thing. And probably since the beginning humans have done things to try to manipulate their moods. Talking was probably the first thing we discovered—story telling, jokes, venting. We’ve all had the experience of just telling something to somebody and having it make us feel better.

In the last episode I mentioned cognitive therapy, which was invented by Aaron Beck in the 1960’s. In this approach he doesn’t seek to eliminate negative emotions, but he seeks to help the person to recognize them and then be able to gain some control over them.

In contrast let’s consider the fact that venting our negative emotions was actually based on a disproved hydraulic theory of emotions. This idea of catharsis goes back to Freud, and he believed in this hydraulic theory. So, he thought that we needed to release negative emotions so that they didn’t build up pressure. Not only has this been disproved, but there is now evidence that reliving negative emotions may do more harm than good.

Studies have shown that debriefing after traumatic events makes things worse. It actually increases the incidence of post-traumatic stress syndrome. And this may be partly because by reliving the traumatic experience the memory is strengthened and it prevents the normal extinction of the memory circuits. So, it turns out that talking about old memories doesn't make them go away, it makes them stronger. Obviously this has a lot of implications for therapy.

There are lots of things that influence mood that are only beginning to be studied—like color, music, smells, and human touch. The value of human touch is beginning to be appreciated more and more. It's probably the reason why massage has so much therapeutic value.

Another way of manipulating our moods is the chemical route. The use of drugs probably goes back as long as mankind; including the use of alcohol. But remember, we recently talked about the fact that not everyone who is depressed has an abnormal serotonin system.

Another area where emotional components are important is with religious experience. And it's well known that a powerful religious experience will usually engage numerous senses such as smell; and they may use drugs.

What is the safest way to regulate our emotions? Evidence indicates that meditation may be one of the safest ways. But don't forget that the body is a part of what is happening. For example, they did an experiment where they gave people detailed instructions to make these facial expressions without telling them what emotion they were mimicking, and the people usually actually felt the emotions just from making the expressions. Actors use this trick all the time.

But not all the parts of our body are under conscious control. For example, the small muscles around the eye only contract when you have a real smile, which is

the reason why most of us don't have any trouble telling the difference between a fake smile and a real smile.

Another question that we might consider is how our emotions affect our thinking. The old idea of the heart vs. the head reflects how we experience the difference between emotions and conscious thought. But now we know that they really both—that is both emotions and conscious thought—involve the brain.

Clearly mood affects our ability to pay attention and to remember. For example, if you're walking down a dark alley and you're feeling anxious, you're more likely to hear every little noise than if you're just walking around your house—so, that's attention level. We normally remember only a tiny percentage of what we experience, but emotion heightens recall; which is actually the opposite of Freud's theory of repressed emotions. But that doesn't necessarily mean that what we remember will be more accurate.

Another odd finding is something called mood-congruent recall, and this is something we've actually all experienced. That is, when we're in a happy mood we remember happy, pleasant memories, and when we're in a sad mood we remember other sad or negative experiences. This is of great interest to people who study memory.

Our mood also affects how we see others. Experiments have shown that if people are presented with the exact same information their response is going to vary according to whether or not they're in a happy mood or whether they're anxious. And they can be primed into either mood. So, for example, if you're given information about a person of another ethnic group or something, depending on what kind of mood you're in you may have a positive or negative reaction. There are also some situations where anxiety actually makes people feel closer.

One surprising research finding is that being happy makes people more susceptible to invalid arguments and less susceptible to valid arguments. This obviously may have some implications for politics. We've all seen how this works just in day-to-day life. When a person is in a good mood they're more likely to be convinced to buy something they don't really need, for example.

Why is this? Well, there's one hypothesis that we have two ways of making judgments—a slow and precise way, and a quick and dirty way—but that we don't always choose the right one. This is one of the ideas explored in the recent best seller, *Blink*. You might think that just using the logical method is always the best method, but that's not really true. For example, when you're judging someone's character you usually do this intuitively, and if you stop to try to analyze it logically you may talk yourself out of your intuitive judgment, which actually turns out to usually be right.

It's been shown that people with brain damage to the emotional areas are easy prey to con men and such things—which makes me wonder whether normal people who fall for con men are really normal. Appealing to emotion seems to offer a more direct way to get people to change their minds than a rational argument. It's easy to see the dark side of this if we consider the events after 9/11, and really throughout history.

Advertisers take advantage of this because they know that it turns out we are going to tend to choose the familiar over the unfamiliar. This was actually confirmed by a famous experiment done by Robert Zajonc back in the late 70's and early 80's. He showed people slides so quickly that they couldn't remember that they'd seen them; and then he went back and showed them the slides more slowly, asking them which ones they preferred. And they consistently picked the ones that they'd seen before. This is called the “mere exposure” effect. It also has clear implications for politics.

But this subliminal exposure was in a neutral environment. It turns out that if you have subliminal exposure with a negative emotional context it can lead to a very strong aversion that you can't explain, because the memory is unconscious. An example of this was shown with an experiment done with a patient with a memory deficit.

The therapist went into the room and had a pin in the palm of their hand, and shook hands with the patient. The next day when they went back in the room the patient avoided them, even though they couldn't remember that they'd ever even met them before. This has practical significance, because sometimes we have very strong negative emotions to things that we really don't have a clue why, because we don't have conscious access to this information.

A last issue that he brings up in the book, and a topic that he's particularly interested in, is the question of whether a computer could have emotions. This brings up the fact that there isn't a universally accepted definition of emotions and that there's a disagreement about the relationship between feelings and emotions. But he argues that if emotions have multiple components it is possibly invalid to argue that a computer could never have emotions just because it lacks all the components.

I wonder, does the lack of a limbic system mean the computers can't have emotions? I would argue that it's the interaction between the brain and the body that sets human emotions apart from any kind of computer simulation. And then, of course, there's the whole issue of the fact that there's not even an agreed upon definition of consciousness and what would make a computer conscious. Obviously this is an area that will be of great interest in the coming years.

So, what are the conclusions that we come to from reading this book? Basically it is that emotions are on a continuum from the basic innate emotions that we all share, up through the higher cognitive emotions, to the culturally determined

emotions. But in general our emotions act to make us more intelligent, even though there are times when they lead us astray.

Or, as he says on page 180, “On balance a creature who lacked emotions would not just be less intelligent than we are; it would be less rational.” And that’s what makes the study of emotions so interesting, is the fact that they turn out to be really important for making decisions that we’ve long assumed were just something we did with our ability to have logic.

I hope you’ve enjoyed this introduction to the subject of emotions. I’m looking forward to talking about it in more depth on future podcasts. On the next *Brain Science Podcast* I am planning to return to the subject of memory, which I think we last talked about in Episode 3.

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Thanks again for listening. I look forward to talking to you next time.

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Transcribed by [Lori Wolfson](#)

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