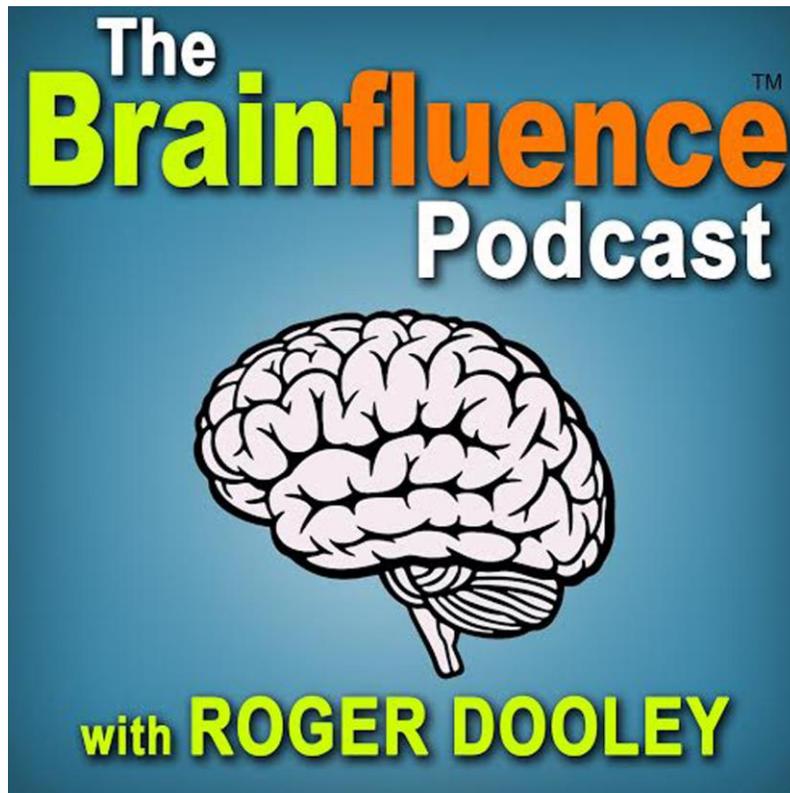


Ep #76: What Your Amygdala Really Does with Joseph LeDoux



Full Episode Transcript

With Your Host



Roger Dooley

[The Brainfluence Podcast](#) with Roger Dooley

Ep #76: What Your Amygdala Really Does with Joseph LeDoux

Welcome to the Brainfluence Podcast with Roger Dooley, author, speaker and educator on neuromarketing and the psychology of persuasion. Every week, we talk with thought leaders that will help you improve your influence with factual evidence and concrete research. Introducing your host, Roger Dooley.

Roger Dooley: Welcome to the *Brainfluence* Podcast. I'm Roger Dooley. Our guest this week is a musician. He's a singer, guitarist, song writer for a New York City band that has released four CDs since 2007. That little musical selection that you just heard was from their most recent album. At this point you may be wondering if you accidentally tuned into the wrong podcast. No, this isn't Groove and I'm not Mitch Joel, and our guest - as excellent a musician as he is - isn't primarily known for his music.

My guest is actually far better known for his accomplishments in the field of neuroscience. He's an expert in how our brains process emotion. If you read the more scientific neuromarketing literature, you'll find him mentioned frequently. He's the author of multiple books about the brain. In particular the ground breaking title, 'The Emotional Brain'. He is the Henry and Lucy Moses Professor of Science at New York University and Director of the Emotional Brain Institute. My guest's newest book is 'Anxious: Using the Brain to Understand and Treat Fear and Anxiety'. Here to light up our amygdalae, but hopefully not too much, is Joseph LeDoux. Welcome to the show Joe.

Joseph LeDoux: Hi. Thank you very much.

Ep #76: What Your Amygdala Really Does with Joseph LeDoux

Roger Dooley: Joe, it's really a great honor to have you on the show. Your work keeps popping up in all the reading I do in my research. I don't conduct primary research, but for my writing I do a fair amount of research. You keep popping up in relation to emotions, and of course since I write a lot about neuromarketing, emotion is really important in that space because one of the divides is all too often our marketing is very fact based and so on. Features benefits and emotions is so important.

First I wanted to talk about your music a little bit. This was something I discovered when I was preparing for the show. As many times as I've seen your name mentioned it hasn't been in the musical context.

Joseph LeDoux: Well that's too bad. I need to work on that.

Roger Dooley: Yeah. You need to step up your PR work on that side of things. Maybe this podcast will be the break that really reaches a mass audience. All of your songs are based on neuroscience. What took you in that direction? Were the big labels missing this deep-seeded hunger in the market for neuro-rock?

Joseph LeDoux: When we first started performing as The Amygdaloids, that's the name of the band. We were trying to find our niche. We did a performance at a club in Brooklyn called Union Hall where a group of science enthusiasts was organizing weeknight entertainment by scientists, lecturers, and so forth. They said, "We'll have some entertainment afterwards." I said, "We'll bring the entertainment." We threw together a band for that show, a band of all scientists actually. All neuroscientists except

Ep #76: What Your Amygdala Really Does with Joseph LeDoux

one environmental biologist. I wrote a song or two for that show.

Roger Dooley: Sometimes you have to compromise for the sake of art.

Joseph LeDoux: Before the show happened there was a little blurb in the Long Island newspaper called Newsday that described our music as 'heavy mental' and I thought that that really nails it. Ever since, in fact our first album was called "Heavy Mental", ever since we've been advertising ourselves that way. We've created our own genre of music about mind and brain, and mental disorders. There's a Facebook page that I've created about that that has all kinds of songs about mind and brain in it. Most music is about mind and brain, and mental disorders. Most rock music, in some way or another, so we're just tapping into that.

Roger Dooley: That's great. I love the titles. On the 'Theory of Mind' CD you've got things like 'Brainstorm' or 'Dreams', 'Piece of My Mind', 'Mystical Memory', so really hitting all the brain bases there. It's great.

Joseph LeDoux: Yeah.

Roger Dooley: Let's leave that for the moment.

Joseph LeDoux: Okay.

Roger Dooley: Although we will link to your music to your show on the show notes page so folks can explore that a little bit more. A lot of your work is focused on the brain structure called the amygdala. We know that's part of our fight or flight reaction, or perhaps a freeze- as you point out in your book too. It's commonly associated with fear. If you ask

Ep #76: What Your Amygdala Really Does with Joseph LeDoux

many people, "What does the amygdala do?", that's the fear center. Last month you published an article basically saying the amygdala is not the fear center. Explain that. What's up with that?

Joseph LeDoux: It's a common misconception. Scientists get sort of lulled into working with the way the public understands the science sometimes. It shouldn't really work that way but we want our work to be appreciated and understood. The quest to do that sometimes we think we have to make it easy to swallow, so corners are cut. Ideas are changed around so that they relate to everyone's experience. All of these years I've been studying how the brain detects and responds to threats, worked out a lot of the details. The amygdala is a key part of that system for detecting and responding to threats.

We do most of this work in rodents, for example. When a human is detecting and responding to threat, we also feel fear. We don't know what a rat, or a mouse, or a worm, or any other animal feels, if it feels anything when it encounters a threat. We do know it responds in a certain way. If we study humans in these situations, and we give them a threatening stimulus, and they say, "Yes. I saw the stimulus, it scared me. My heart is racing, I'm kind of tense, my muscles are tense." Which is part of what freezing is all about, tensing up the muscles.

The person has all of those things together in their conscience mind, but when you take these things apart in the brain what we see is that the threat detection system is separate from the system that gives rise to conscience feeling. If that same person were in the lab and I presented those stimulus subliminally, so the person

Ep #76: What Your Amygdala Really Does with Joseph LeDoux

didn't know the stimulus was there, it had no conscience feeling of fear of anything else in response to that stimulus, and yet the person's heart is beating, their muscles are tensing and so forth. Their brain has detected and responded to a stimulus that they don't know even exists. There's no feeling involved. The amygdala is lit up like a lighthouse in the brain when you present those stimuli either liminally or subliminally, but that's not what causes you to feel fear.

The conscience feeling of fear is a cognitively constructed process involving the highest centers of the brain. For example, the prefrontal cortex and areas like that, that put together the fact that the amygdala is activated and it's causing the brain to be highly aroused, and chemicals are coming from the body back to the brain. All of those things are happening. The amygdala is contributing in an indirect way, but the conscious feeling of fear is the representation that all that stuff is happening as a result of the amygdala activation together with the fact that you see there's a stimulus there that you know from memory that is threatening. You may also retrieve personal memories of having been threatened by that stimulus, say it's a snake. All of that comes together as an immediately present state of mind that we call fear.

That state will often quickly morph into the state that we call anxiety. Let's say there's a snake at your feet. You're afraid of it. You're consciously aware that it's there. You're nervous about the fact that that snake is there. You start to worry about what's going to happen if that snake does what you anticipate it might do. That's when we shift from fear, which is an emotion present when the stimulus is immediately in your presence. Whereas anxiety is a worry

Ep #76: What Your Amygdala Really Does with Joseph LeDoux

about something that hasn't happened yet, that may happen, but may not happen.

You can be just as anxious about alien abduction as you can about what the snake is going to be doing to you. It doesn't have to have the physical reality basis. It simply has to be something that, in your head, you view as threatening.

Fear and anxiety are different in that way. Fear is an emotion to an immediate stimulus. Anxiety is an emotion, feeling to an anticipated stimulus, and both of those feelings are separate from the brain systems that detect and respond to danger. The systems that detect and respond to danger are a part of that. They contribute to that feeling, but they are not one in the same. We need to keep that separate because the scientists get lulled into thinking that they are studying fear as well.

You go to Society of Neuroscience, the most esteemed conference that neuroscientists have every year, you can find countless posters of researchers standing at their post or telling the audience that we used freezing as a measure of fear in a rat or a mouse. What they think is happening is, or they're acting as if they think this: that when the brain detects danger it creates a feeling of fear in the amygdala, and that feeling of fear triggers those responses, but the feeling of fear is not in that sequence. It's not part of that circuit. It's not necessary to have those responses.

This view that was also typified in the otherwise wonderful movie 'Inside Out', which has become viewed as a scientific discourse on how emotions work. It is one view.

Ep #76: What Your Amygdala Really Does with Joseph LeDoux

It's the basic emotion view of how emotions work, but I don't think it's correct. I don't think that you have these states of mind in your brain, fear or sadness, and so forth that are driving your behavior in the way that it's depicted in that film, and the way that we all think about in our daily lives.

Roger Dooley: If rats are not necessarily a good model for humans because the higher level of processing that humans have, what about primates, monkeys, or apes? Is there a continuum there, or are those creatures too lacking that next level of cognition that would create anxiety?

Joseph LeDoux: First of all, rats are an excellent model. A very important part of the fear response, that system that detects and responds to danger is a key component of what you ultimately feel, but it's not based on fear. That's an important distinction that I'd like to spend a minute by describing what happens when researchers try to develop drugs to treat anxiety, for example.

When the researchers want to find a new drug to give better treatments for people who are suffering from fear and anxiety they put rats and mice into challenging situations where they're exposed to some kind of novelty or uncertainty, or an immediately present threat and so forth. What they find is that the rats are more inhibited, more timid in those situations. What they look for is a drug that makes the rat less behaviorally timid, or what sometimes called behaviorally inhibited.

A rat that is less behaviorally inhibited in the presence of the drug is assumed to be less fearful or anxious. You give the drug to people, and they don't necessarily feel

Ep #76: What Your Amygdala Really Does with Joseph LeDoux

less fearful or anxious, and big drug companies are getting out of the business of finding new anti-anxiety drugs like GlaxoSmithKline, one of the big ones, because people aren't feeling better when they're on these drugs.

Roger Dooley: What you're addressing is more the threat response rather than the follow on emotions that go with that.

Joseph LeDoux: Right. The person who's on an anti-anxiety treatment because they have social anxiety disorder, for example. They person, like the rat or mouse, is less inhibited. They can now go to the party, but when they go to the party they still feel anxious. We have to recognize that these are different systems in the brain, and they each have to be treated separately. There's no one-size-fits-all. You have to design treatments that target the unconscious processes and design treatments that target the conscious processes, and deal with them separately.

Rats are very good for studying those non-conscious processes. You asked whether primates might be the better. The problem is, when you leave the realm of humans with our ability to communicate by language, it becomes almost impossible to know what another organism actually feels. In humans we have two kinds of responses that we can go on. One is a verbal response: Yes. I saw the stimulus. Yes, it made me afraid. The non-verbal responses; the heart is beating, the palms are sweating, and so forth. It can be measure in physiological terms and behavioral as well. All objectively measurable. When you go to a non-human primate, or a rat, or any other animal, all you have are the non-verbal responses. It's very difficult to know when a non-verbal response, like a behavioral response or physiological measure, is telling

Ep #76: What Your Amygdala Really Does with Joseph LeDoux

you that a response that the brain has processed that stimulus consciously or unconsciously because you don't have that parallel system, the verbal system, to say, "Yes, I was conscious of that."

Verbal report are not perfect. There are problems with it, but at least most of the time, people are- unless they're trying to deceive you or otherwise have issues where they can't ...

Roger Dooley: That's the basis of neuromarketing is that people can't always tell you what they feel or what they want, but definitely a lot of self-reporting is valuable.

Joseph LeDoux: I would qualify what you just said because I think we need to clean up our language about the way we talk about things. I don't think you can have an unconscious feeling. A feeling is something that is felt. In other words, you are experiencing. If you can't experience it, if you can't tell me "I'm feeling that." then you aren't feeling it. You may be having, in fact you are probably having a lot of other non-consciousness responses in your brain. Even complex cognitive processes, but they're not percolating up into the conscience mind.

When you're studying marketing, as we were discussing earlier, I actually have a couple degrees in marketing. I started out studying business administration specializing in marketing, that got me interested in psychology. I went on to do a master's in marketing with a focus on consumer psychology, and in that process I got more and more interested in psychology. Took a course with a guy studying the brain and said, "This is what I really want to do." This was a long time, thirty-five, forty years ago. I've

Ep #76: What Your Amygdala Really Does with Joseph LeDoux

been in the neuroscience game for a long time. I do have an appreciation for the fact that marketers need to convince people, or sway them to buy this product versus that product. It's been said that unconscious information processing is most effective when you don't know it's happening. If you're conscious of some stimulus it's also going to be going into your conscious mind, but your conscious mind can help protect you, guard you against those unconscious messages. Information that goes in non-consciously because the conscious mind is distracted or because it's been put in subliminally is less under guard.

I don't know how ethical this is to tell you how to get people to buy stuff by going deeply into their unconscious minds, but that's a whole other issue.

Roger Dooley: I'd say that the typical emphasis in neuromarketing isn't so much on somehow bypassing conscious processing, although certainly it's common to use imagery or other things that have that kind of impact, but also an understanding of how people really feel about things. If you show somebody new product and say, "What do you think about this product." They may well tell you that they like it, and they like it's features. If you are able to get a little bit deeper through one of the many techniques out there. Whether it's EEG or fMRI, or facial coding, you may find that they really don't feel that good about it. They find that it's complex or something of that nature.

Part of the problem with neuromarketing is to avoid wasted money, not so much to create super powerful ads, but to find those ads that really suck and aren't going to

Ep #76: What Your Amygdala Really Does with Joseph LeDoux

convince anybody of anything because they're tuning them out. Get rid of those.

Joseph LeDoux: Most of what happens in the brain happens at a non-conscious level. Freud really nailed this, he didn't get everything right. He certainly got one thing right, which is consciousness is the tip of the mental iceberg. Most of what our mind is doing is done non consciously. Some people think non conscious means non mental but that is absolutely not the case. Like I just said, that is absolutely not the case. That was a linguistic phrase. I didn't consciously chose those words. I didn't put them in the proper sequence schematically. Yet, it is a process, a complicated cognitive process that goes into that kind of decision making.

If you're sitting in a room and you see one person is closer to you than another person, your brain is computing some complex geometric relationships. You have no idea how it's doing that, just as you have no idea how it's doing the programming of your speech parts and their relationship to one another.

A lot of what the mind is doing it's doing unconsciously or non-consciously. I prefer the term non conscious since unconscious does have more of a Freudian implication so I try to use non conscious most of the time.

Roger Dooley: How much do you use brain imaging in your work, Joe?

Joseph LeDoux: My lab is focused on the more basic neuroscience aspects of all of this. I have a colleague at NYU, Elizabeth Phelps, who does a lot of different things. One thing she does is human analogs to the rodent work. We've been able to verify to a first approximation that all of the

Ep #76: What Your Amygdala Really Does with Joseph LeDoux

discoveries that we've made in the rodents at this very basic level of threat detection and responding apply to the human brain. Obviously we don't study conscious fear in the rodents because as I've said, I don't think we can do that. Not because they necessarily don't have any feelings, but because we just don't know scientifically how to get in and assess what they're feeling at all. We can measure responses but those, again as I've said, with feeling should be left as a conscious term with conscious designation, and all the non-conscious stuff talked about in a different way.

Yes. Through my collaboration with Elizabeth Phelps we've been able to do quite a number of fMRI studies that validate the basic principles that we've discovered in the rodent work.

Roger Dooley: You're putting the rats in the fMRI machine as well?

Joseph LeDoux: No. Humans.

Roger Dooley: That might be interesting though to see what's happening in their little brains.

Joseph LeDoux: Yes. There are new techniques. You can't put a rat into a human fMRI machine because it doesn't ...

Roger Dooley: And probably GE does not want to develop a rat size MRI.

Joseph LeDoux: There are fMRIs for rats and even mice. They have a much stronger magnet because it's small sized. Those are special devices, but they can be used.

Ep #76: What Your Amygdala Really Does with Joseph LeDoux

Roger Dooley: We started off by talking about the simplification of fear and anxiety, and how often times in an effort to help people understand the science things are simplified. It seems like a lot of the simplifications of how the brain works end up proving to be not entirely accurate. For a while there was the right brain, left brain thing. You certainly did some work in that area, and became popularized. It's complex. There was a trying brain theory, which certainly is a simplifying concept that may still be useful but it probably isn't widely accepted as being a perfect model for the way our brains work.

Joseph LeDoux: I think the trying brain concept is important in the same context of what we've been talking about here. Which is that there are relatively newer, and relatively older, and relatively very old systems in the brain, but we're not talking about emotion systems the way the trying brain really was talking about that.

There are systems that are doing these things like detecting and responding to danger, and sorting out mating activities and feeding activities. Every animal has to do five things to stay alive. It has to detect and respond to danger. That's primary because if you don't do that it's all over. It has to incorporate foods or nutrients from the outside. It has to balance its fluids with the outside. It has to thermoregulate, and reproduce if its species are going to survive. Those are the key thing that they trying brain was looking at as evolutionary conserved across species including humans, but the problem was that it did the common confusion of assuming that those things like threat detection was equal to the feeling of fear, that the mating systems are there to make us feel pleasurable, and that was the wrong idea.

Ep #76: What Your Amygdala Really Does with Joseph LeDoux

We've got to take the subject of component out of these systems and put them into areas where they belong. What's really interesting about those five activities that I just mentioned- they are not only present in humans, and rats, and mice, and fish, and even bugs and slugs and worms- also in bacterial cells and other single cell organisms. A bacterial cell has to do all those things, detect danger, incorporate nutrients, balance fluids, thermoregulate, and reproduce.

These processes are as old as life itself. They're not in the brain to make us feel anything. They're in the brain to keep us alive. These are survival functions. The circuits in the trying brain that were supposed to be in motion circuits are really survival circuits. Emotion is a secondary process that's added on by these cognitive systems, especially in the human brain. Possibly in other animals but we simply don't know.

Roger Dooley: Let's get to your new book 'Anxious'. Who is your intended audience, Joe?

Joseph LeDoux: I've written three books. The first two have done quite well. In both cases, for those two books, the intended audience was the lay public. Neither one of those books was especially easy to get through because my principle in writing those books was to write a book that would be scientifically accurate that people would be able to get something out of, but would not embarrass me in front of my colleagues. I think succeeded with those two. I think synaptic self was the most difficult of the three books I've written. The book 'Anxious' is also written for the lay public, but also for colleagues as well, or can be used in classrooms as all the other books we've used.

Ep #76: What Your Amygdala Really Does with Joseph LeDoux

The lay person may not get every nuance, every little detail, in this book, but it's all going to be scientific lacquer. You can cherry pick: read the chapters that are most relevant to you. There are chapters on the basic principles that I've been describing here in this conversation. There are also three chapters on how to understand therapy from the point of view of how the brain works.

I think there's something everyone can get out of this. They are written, I think, in a fairly user friendly way. Although in some areas you get into some technical details that are necessary to convey some of the scientific rigor. If there's something too technical people can just skip that and move on to the less technical stuff.

Roger Dooley: You've said that the chemical treatments for anxiety haven't necessarily been treating anxiety. Is there hope of developing such compounds? Is there a future in a neurochemistry for anxiety?

Joseph LeDoux: That's a hard question to answer. What is fear or anxiety? It's a conscious state. You don't simply change fear or anxiety, you change consciousness. I'm not sure we want to do that. I think we have to rethink exactly what our goals are. Drugs are very good at targeting systems that control specific behavioral responses. By proxy and indirectly ... let's say one of the consequences of activating the amygdala is arousal. In anxiety disorder it's one of the problems that people have is hyper arousal. They're overly aroused. There's too many chemicals floating around in their brain. The drugs are going to target and reduce the arousal. That is going to make it easier for them to treat the conscious mind, in other

Ep #76: What Your Amygdala Really Does with Joseph LeDoux

words the conscious feelings of fear and anxiety, through other means. For example, traditional talk therapy. That's not going to work so well if the person is still hyper aroused.

You have to have a combination. A lot of therapeutic work is based on that idea that you have to go get drugs and talk about things, but it's not being done in a way that I think can be more efficient.

For example: In order to attack the non conscious systems, it may be important to present the stimuli that may be involved. For example, if you have a phobia or the trigger stimuli in PTSD, or other conditions, you would want to present those stimuli subliminally so the person of the conscious mind doesn't know the stimuli is there and you would do exposure therapy subliminally. You may also supplement that with drugs. Either drugs that are meant to reduce hyper arousal in general like SSRI's. A more targeted way would be to combine exposure therapy with drugs that facilitate non conscious learning.

There are drugs called ... One drug that's been used quite a bit for this is something called d-cycloserine. This was discovered in studies of rats, it makes the extinction or exposure process more efficient. Exposure therapy is notorious for being temporary. The results only hold us away for a while, then the responses pop back up. When you combine exposure therapy with the d-cycloserine, you get a stronger exposure effect. Therefore the response is less likely to come back up. There are ways to do that behaviorally that we've discovered. It's a long complicated procedure, but it has to do with the timing of

Ep #76: What Your Amygdala Really Does with Joseph LeDoux

the exposures in exposure therapy, and all of this is described in 'Anxious'.

I guess the point is that we can treat the non-conscious mind with drugs, but a more targeted way is to go after the trigger points, the trigger stimuli, non-consciously. If those can be reduced the hyper arousal is going to go down. If the hyper arousal is down, then the conscious mind can be treated more effectively, changing beliefs and attitudes, and other things that sustain worrying thoughts. You can't get rid of those if the hyper arousal is there. If you get rid of the hyper arousal you can better treat that. You can't just change the beliefs and thoughts because the hyper arousal will still be there and it's all going to be interacting.

In 'Anxious' I organize all this in a way that suggests ways to target the different systems by first attacking the non-conscious and then going to the conscious.

Roger Dooley: Do you think you'll ever go back to your marketing roots at all and try and apply some of what you've been learning for the last decade in that field?

Joseph LeDoux: I'm always available for a consultation. I know where my home is now and I think I'll probably be sticking it out as a neuroscientist for the rest of my career. I'm getting up there in age so at some point I'll retire. Maybe I'll consider going into marketing when I retire.

Roger Dooley: Let me remind our listeners that we're speaking with Joseph LeDoux, neuroscience professor and researcher at New York University. His new book is "Anxious: Using the Brain to Understand and Treat Fear and Anxiety. There's even a separate CD that explores the book's

Ep #76: What Your Amygdala Really Does with Joseph LeDoux

themes using music. Joe, where can people find you and your content online?

Joseph LeDoux: My laboratory at NYU has a website that you can find out what we're doing there. It's cns.nyu.edu/ledoux. That's the lab website. I'm on Facebook as Joseph LeDoux. I'm on Twitter as @theamygdaloid. I have a band website called Amygdaloids.com where all the music is. In the book you can use your smartphone in the preface to scan a QR code which will then allow you free access or free download to the companion cd called 'Anxious', which has all the songs about themes in the book.

Roger Dooley: That's great. Of course we'll link to all those resources as well as your other books and music on the show notes page at rogerdooley.com/podcast. There will be a text version of our conversation there too.

Joe, thanks so much for being on the show. It's been a pleasure.

Joseph LeDoux: Thank you, Roger.

Thank you for joining me for this episode of the Brainfluence Podcast. To continue the discussion and to find your own path to brainy success, please visit us at RogerDooley.com.