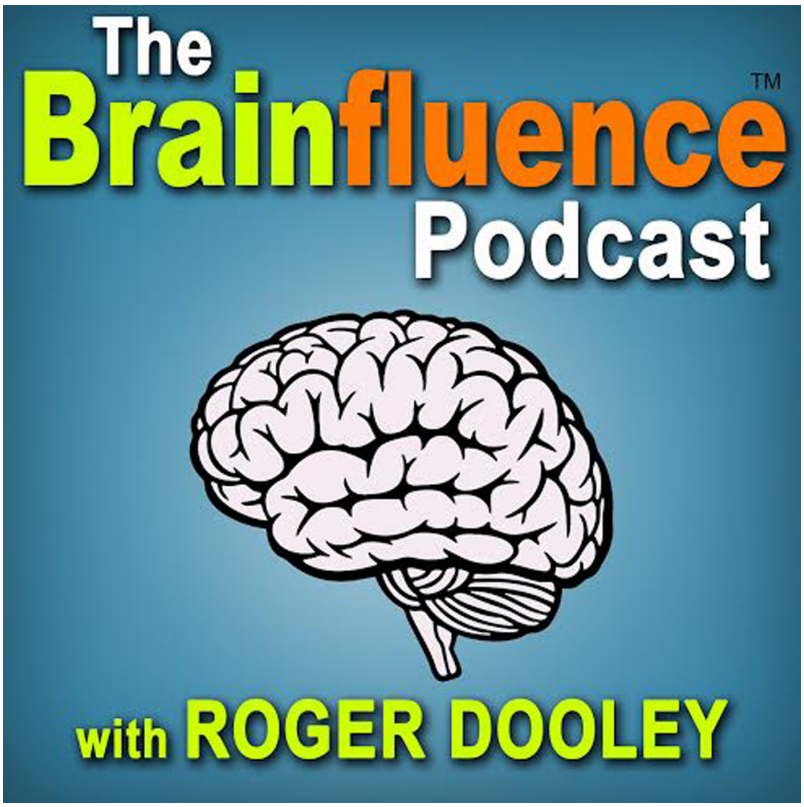
Why Curiosity Is So Powerful with Mario Livio



Full Episode Transcript

With Your Host

Roger Dooley

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Roger: Welcome to the Brainfluence podcast. I'm Roger Dooley. Before we begin, I'll let you know that you can find the show notes page for this conversation at RogerDooley.com/podcast. We'll have links to any resources we mentioned, plus a text version of our conversation there, too. So, if you're listening, and hear something you want to refer to later, just go to RogerDooley.com/podcast.

I'm pretty our guest this week is the first astrophysicist we've had on the show. But, we're not gonna be talking about black holes, or red shift today; at least, I don't think so. Mario Livio, like the best scientist, is a curious guy. He's written six books, and published over 400 scientific articles. He's the science advisor to Baltimore symphony orchestra, a role you probably didn't know existed. He's been on 60 Minutes, Nova, and The Daily Show. And, as a curious scientist, Mario has a new book, Why; What Makes Us Curious? Mario, welcome to the show.

Mario: Thank you for having me.

Roger: So, Mario, you spent about 25 years as a scientist with the Hubble space telescope project. A lot of science these days seems to be about verifying the predictions of earlier thinkers. But, I'm curious; did you have any big surprises during your Hubble years?

Mario: Oh, yeah. Many surprises. I mean, perhaps the biggest surprise came in 1998, when we discovered that, not only are universes expanding, which we knew since the late 1920's, but we thought that that expansion should be slowing down, a bit like when you throw a stone on Earth, and the gravity of the Earth slows it down as it moves upwards. We thought that all the mass in the universe should slow down, through gravity, the expansion of the universe. Instead, we discovered that the expansion is speeding up. It's accelerating. And we now know that that's propelled by some mysterious form of energy we call "dark energy", which permeates all space. And that's one of the biggest puzzles, as to what that dark energy is.

Roger: Well, there's still stuff to be curious, then. Another one of your interesting books from the past that isn't really related to the current topic, but I think our readers might find interesting, our listeners; it was The Golden Ratio; the Story of Five, the World's Most Astonishing Number. In the past, I've written articles about using the golden ratio, in designing websites and advertising. Why don't you briefly explain what the golden ratio is, and how it's been a part of art and design.

Mario: The golden ratio is really a number. It's 1.618, and it goes on forever with digits forever. And it was discovered by the ancient Greeks. Basically, they discovered that, if you divide a line into two unequal parts, in such a way that the long part to the short is the same as the whole line to the long, then this ratio becomes this number; 1.618, and so on. The nice thing about this number is that it pops up in unexpected places.

You mentioned one; at some point, some people decided that, if for example, you look at a rectangle, then the

rectangle that is most pleasing to the eye, in which the length to the width is exactly the golden ratio. Now, I would say it's very controversial, whether that is actually true or not. But, it is true that we don't like rectangles that are either too elongated, or too square. So, the golden ratio is somewhere in there.

But, the golden ratio does appear in a variety of natural phenomena; things ranging from the arrangement of leaves in plants, through such things as there are these things we call "quasi crystals", which are not quite crystal or quite amorphous, and they appear in that. But, indeed, the way that it has been used most in advertising, or even in actual art, some artists who knew about the history of this number used it. Salvador Dali, for example, the famous painter, has one painting, the Sacrament of the Last Supper, where the dimensions of the painting are in a golden ratio. So, yes; it's a very famous number.

Roger: Mm-hmm (affirmative). But, maybe it's not quite that precise. Because I know one application that occurred to me is, when I give a speech, as with most folks who are using common tools today, the slides are in a 16 to 9 ratio. And that's pretty close; it's a 1.78-er. And that's kind of in the neighborhood. Do you think that's good enough?

Mario: Well, yes, because, you see, that's what I'm saying, is that we don't like things to be too elongated, or too square. And, yes, the golden ratio happens to be in that range. But, to claim that the golden ratio precisely has some advantage in terms of aesthetics would be pushing it. Because we can not even with our eyes tell something that is precisely in the golden ratio.

Roger: Right. Good. Well, I think PowerPoint users around the country are breathing a sigh of relief right now. So, I can ask you one more question about a previous book, and then we're gonna get onto your current book. Your last one was Brilliant Blunders, and describes serious mistakes by five notable figures in science, including scientists like Darwin and Einstein. Do you worry that that gives fuel to the science deniers out there? It just sort of shows, "Well, you see, we told you that science was often wrong."

Mario: Well, I certainly hope not. I mean, science is very often right, and occasionally it can be wrong. The point I wanted to make was that we try to encourage thinking in unconventional ways, thinking outside the box, thinking outside the mainstream. And when you think in unconventional ways, you sometimes may make a mistake. But, you will notice that I call my book "Brilliant Blunders", and not "Sloppy Blunders", for example. I don't advocate people making mistakes because they are not being thoughtful, or being sloppy. The things I called brilliant blunders were things that were done after a lot of thought. And, yes, they turned out to be mistakes; but, those mistakes actually led to important breakthroughs. And those are the things I call brilliant blunders.

Roger: Right. Well, I think that's probably a good life lesson as well, because we think of Steve Jobs as having this tremendous intuition about product design, but not everything that he and his teams came up with was a success. Some were failures. But, you've got to sometimes make some mistakes, have some bad ideas, to have the really good ones.

Mario: Right. In any creative process, if you think that this is going to be some sort of a direct march from A to B, this just doesn't happen. I mean, every path like this to success is a zig zag path that goes through many false starts, and blind alleys, and many times, you have to go back to the starting point, until you actually get there.

Roger: Great. Let's talk about your current book, Why, Mario. What made you curious about the science of curiosity?

Mario: That's actually very simple. It's just the fact that I'm a very curious person, myself. I've always been curious, both about the science which I do, but also about other things; music, art, and so on. And, at some point, I just became very, very curious about curiosity, and how it works, and what do psychologists think about this, neuroscientists. So, I decided to devote more than four years to actually studying that subject, reading lots of the papers that have been written, interviewing many, many psychologists and [inaudible 00:08:21] scientists, visiting labs, to just find out what is known, and what we would like to know more about curiosity.

Roger: Mm-hmm (affirmative). And I think it's a topic that actually has some practical implications, too. Because, in your book, you describe how curiosity is actually closely connected to our brain's rewards system, and also to the formation of memories, right?

Mario: Yes. Indeed. I mean, look; curiosity actually powers, at some level, almost everything we do. You don't even have to want to have a conversation with somebody, unless you're somewhat curious about what this person has to say, right? And, for sure, you know, when you read a book, when you see a film, when you see a TV

program, when you see an advertising, if it doesn't make you curious, it really doesn't work. So, curiosity is essential to almost every aspect of our lives. And, indeed, it was found it is related to the reward system. Because, in particular, certain types of curiosity, what is known as epistemic curiosity, is our love of knowledge; wanting to learn new things is really very intimately connected to the reward system. We see this knowledge as a reward. In our brain, there is an anticipation of reward when we learn new things. So, that's another thing.

You mentioned memory. Memory's enhanced when we're curious about things. And the amazing thing is that memory, not even just of the things that you are curious about ... Because, of course, you remember better things you are curious about than things that bored you stiff. But, even incidental memory, things that were not related directly to the things you were curious about; even those you remember better when you're in a state of curiosity.

Roger: So, Leonardo Da Vinci's a big part of your book, Mario. He's got to be the model of the curious human who followed his curiosity wherever it went. Why was he so unique, and why don't we see more Leonardos today? Or, are they really out there, they just haven't been around long enough to be known so well?

Mario: I'm sure there are many curious people today. And I also discuss Richard Feynman, for example, the famous physicist was also an extraordinarily curious person. Leonardo was ... There is a range, of course, of the intensity of curiosity that people have. And Leonardo probably was at the very top of that range in the sense that he was curious literally about almost everything, with the possible exception of politics, which he wasn't

interested in; and for good reasons, he lived at the time of the [Borgas 00:11:08], and they basically killed everybody that didn't agree with them. So, it was probably wise of him to stay out of politics.

But, yes, he was interested in everything near and far. And those people are rare. But, it's in the same way that people who have talents like Mozart are rare, and things like that.

Roger: Mm-hmm (affirmative). Do you think that one reason that Leonardo was able to be so successful was because knowledge was comparatively limited in his era? I mean, today, I might be curious about [metalergy 00:11:39] or etymology, but to get to the borders of what's already known, I'd probably have to get a Masters, or a PhD, or at least devote a few years to studying that particular discipline before I was able to push the limits of it; where, Leonardo often was just dealing with knowledge that was pretty much historic, and not necessarily fact-based, in his time.

Mario: Yes. But, you see, you have to compare Leonardo not to people today, but to people of his time. And even compared to people of his time, he was extraordinarily curious. So, it's not as if he just had it easy, because fewer things were known. The same situation was true for almost everybody else. And yet, he was way more curious than almost anybody else.

Roger: Mm-hmm (affirmative). Right. And I think your Feynman example is a good one too, because he wasn't a brain expert, but he quickly came up with a handful of experiments to narrow down how people experience and measure the passage of time. So, he wouldn't necessarily

know everything about neuroscience, but he could take that one little thing that intrigued him, and rather quickly, sort of push the limit in that area.

Mario: Yes, you're right. I mean, basically ... And the thing is, it started with a very, very simple trigger, and that's what's so interesting about people who are exceptionally curious. He's saw in one article that somebody, some biochemist, or somebody claimed that our perception of the passage of time has to do with some chemical reaction that involves iron. And that seemed, to him, to be not particularly logical. And, even though this was completely outside his field, he decided immediately that he wants to test what it is that actually determines our feeling of the passage of time.

Roger: Yeah. One other historic reference was Darwin's curiosity involving beetles. I'll let you tell that story, but it's hard to imagine the typical academic researcher today having quite that level of curiosity.

Mario: Yeah, you're right. Darwin was crazy about beetles at some point in his life. This is after he arrived to Cambridge. Yeah. He was trying to collect beetles wherever he could, and one day, he was sort of moving in the forest, and he found two beetles, was holding one in each hand. And, at that point, he caught a glimpse of a much rarer beetle that was there. So, because his hands were not free, he popped one of the other beetles into his mouth, in order to be able to catch the rare beetle. I mean, you really have to be curious in order to do such a thing.

Roger: I guess so. I'm sure there's probably one or two of your colleagues that would have that level of devotion to their

science. So, one researcher, moving up to contemporary times, that I've spoken to, but never met in person, but who's done some amazing work in psychology and neuroscience, is George Lowenstein from my alma mater, Carnegie Melon. He pops up everywhere; he, and Stanford's Brian [Neutson 00:14:46] discovered what they call "the pain of paying". He and Dan [Arielli 00:14:49] did some work on how arousal changed our decision making. And in your book, you refer to his work on the information gap as sort of a key concept. Can you describe that, briefly? What is the information gap theory?

Mario: Yes. That has been an extremely influential theory in the models of curiosity. And, indeed, George is the one who proposed that; based, mind you, on ideas of previous researchers, such as Daniel [Berline 00:15:17], and others. So, the idea is the following; that, when we see something that surprises us, or that doesn't quite agree with what we know or think we know, some sort of a gap is formed in our mind, and that gap is felt as an aversive state, as an unpleasant state. So, curiosity, in that case, acts to actually relieve us of the unpleasantness. It's a bit like ... So, curiosity in this model, is a bit like an itch that we need to scratch. And it has been shown that at least some types of curiosity ... In particular, one is called "perceptual curiosity", which is the curiosity when we see something that surprises us, or something ambiguous ... Indeed activates in our brains, it activates those parts that are usually associated with conflict, or with hunger.

So, indeed, at least some types of curiosity have this thing that they cause us to have this information gap, and this unpleasant feeling, which we need to remove.

Roger: I guess that's one thing that marketers or storytellers can do to get people interested, right?

Mario: Oh, yeah. This would be, perhaps, the thing that marketers can do; is generate this information gap. Basically, the idea is the following; we're not so curious about things we know absolutely nothing about, because we don't know what to be curious about. And we're not so curious about things we know a lot about, because we think that maybe what we don't know is not worth bothering with. When we get really curious is when we know something about something, but we feel or know that there is much more to be known.

So, the idea is, indeed, to generate this type of information gap. To give you an example, research showed that we are much more distracted by hearing somebody speaking on their cell phone, let's say, when we only hear half the conversation, than we are if we actually hear two people talking to each other, and we hear both sides. So, these [halfalogs 00:17:35], they have been called, these half of conversation, it makes us much more curious. Because we really can not predict the flow of a conversation, and we have this information gap, and that's what makes us very curious.

Roger: Interesting. Our brains are trying to fill in the blanks, there, and get more intrigued by that. I think one good ... It's a good example, although, not necessarily a desirable example; are some of these click bait headlines that you see in the margin. You're reading a news article, and then, you look over to one side, and there's this, "You won't believe what Lady Gaga did when she met Kim Kardashian!" And they don't tell you what's going on. They just drop a few hints that, "Wow, it involves these

celebrities." It seems like probably the majority of those click bait headlines somehow only provide you partial information, and imply that you're gonna get the rest when you click through to their link.

Mario: That's right. And they sometimes would even have an image, which it turns out has nothing to do with the actual story. But, the image acts as a bait as well.

Roger: Right. Well, personally, I've never clicked on one of those, so I wouldn't know. But, some friends have told me that. Yeah. It is interesting. And I'm sure those are optimized, too; that they've tested 15 different images, and let the software choose the one that gets the most clicks. Something that I found kind of counter-intuitive is that people enjoy uncertainty. It seems more intuitive that people would like being certain about things. But, why does that seem to actually create a little bit of pleasure in our brains?

Mario: Not in most cases, actually. In most cases, uncertainty is felt as an unpleasant and aversive situation. But, there are some exceptions. And the exceptions are, when you actually know ... There is an uncertainty, but you know that the outcome is likely to be a positive thing. For example, when you're expecting a child, and you don't know the gender. There are people who prefer not to know the gender of the child until the child is born. Because they know that something good is gonna happen, and they like to prolong this uncertainty state, when they know that the outcome is good. They would not be in a good state if, for example, they waited for the results of some medical exam that could prove that they have some horrible disease.

But, when they absolutely are sure that the outcome is a positive one, they may be in a pleasant state, even in the uncertainty. A similar thing happens with ... The US Open is happening now, as we speak. And there are people who, they try to record the matches, but they don't want to hear the result until they actually watch, because they enjoy this uncertainty, but about something that they know is, to them, very pleasant.

Roger: Right. That makes a lot of sense, because I know I've occasionally taped, say, a football game or something, and feel the same way. If the team you're hoping would win loss, then, gee, why would you watch that? It's just gonna be depressing. But, even if they won, it takes some of the fun out of it. And I suppose it would be kind of like, your lottery ticket is a winner, but you don't know what it is yet. But, you're gonna enjoy that uncertainty for a little while. I wonder if even some of these hidden discounts that, "Come into the store to find your secret discount by scratching something off, or opening up a box with a key," or something like that ... As you say, the outcome is going to be positive, you're gonna get some kind of a reward for doing that, you just don't know how much.

Mario: Right. Right. So, when you absolutely know that the outcome is positive, then you may enjoy the uncertainty state. When you don't know if the outcome is positive or negative, then uncertainty is usually perceived as an unpleasant state.

Roger: Mm-hmm (affirmative). Are there any tricks to storytelling that sort of maximize, perhaps, the uncertainty, or at least keep the reader going, and keep their curiosity intrigued, to keep them moving along?

Mario: Of course. And, you know, people who write thrillers, for example, do that all the time. Some of the best of them, they end every chapter, or sometimes even every section with a cliffhanger. That's a sure thing to try to do. That's being done also in TV episodes, in many commercials, in all kinds of things like that, where you're left hanging, and you can not wait to continue to read, or to watch, or whatever the medium is that you're doing.

Now, there are more subtle things, and I give one example in the book of this. 19th century author [Kate Chopin 00:22:29] wrote mostly short stories, but also a couple of novels; she just generates the curiosity with what I tend to call an intellectual cliffhanger. Namely, you're trying to understand the motives, and the things that drive the protagonist all the time. And that is done, again, through very clever prose.

Roger: Mm-hmm (affirmative). I recall one line from that, where one part of it finished with, "Then, there was a knock on the door." And it's not exactly a thriller, where somebody's hanging from the cliff by a branch, but that curiosity of, "Who is it? Are things gonna change?" And I think that probably is a good lesson for those folks who are either doing content marketing, or writing copy, because there's a real tendency, I think, as a marketer, to be very direct in your explanation.

In other words, if somebody has a great story about how your product helped them succeed, in the headline, you're gonna put, "Product helps this company succeed," and you're gonna start off with a pretty direct explanation of how well the product worked, and so on, instead of building at least a little bit of suspense, starting off with the problem that was facing the manager in question, the

dilemma that the company faced, and then just sort of letting it unfold until you finally get to the solution. And, to me, that seems like a much more interesting and engaging approach, even though it's probably not the way most content is written.

Mario: Well, it probably has something to do, also, with the amount of time that you have available. I mean, if all you have is a few seconds, you want to give the main information. If, on the other hand, you have the luxury of doing a somewhat lengthier thing, then of course, you can do all these kinds of tricks.

Roger: Mm-hmm (affirmative). And I suppose too, even in internal communications, that would work. Because, again, we have such a tendency to be direct. But, I should probably have a little sign on our wall that says, "Keep the audience curious," as a reminder. So, Mario, what's your next topic of curiosity going to be? Have you pretty much scratched your itch on the science of curious?

Mario: Well, the thing is, one of the things I discovered while researching for this book is how little we actually know. I mean, we know, by now, much more than we did before. But, for example, one of the things that surprised me was that there are these different types of curiosity; one that is felt as an unpleasant state, and another one that is associated with anticipation of reward. Had we known this from the beginning, we might have even used different words for the two types of feelings. We use the same word "curiosity" for rather different things.

There are two other types of curiosity that I did not mention yet here. There is diversive curiosity, which is what young people do when they continuously check for

new text messages on their smartphones. This is basically something to ward off boredom. And then, there is specific curiosity, which is when you need to know a very specific piece of information, like who manufactured this particular product. And those are, in today's modern world, easier to satisfy, because we can Google them, or use other social media to actually find the answers relatively fast, while before, we had to spend a lot of time, perhaps, trying to find that type of information.

Now, at this point, I'm not a neuroscientist myself, and I think we have to now let the neuroscientist and the psychologist continue to do their work, because progress is fast, but not that fast. So, I would probably come back to this topic in a couple of years, to see how much progress has been achieved.

Roger: Mm-hmm (affirmative). I was just reminded of something at the beginning of your book, where you refer to the concept of a "infovore", and that really, our brains hunger for information. And I think that ties in very well to this. People want information. They want new information, in particular. If you can give them that new, interesting information, you'll hold their attention.

Mario: Right. And what's interesting about that is that that particular type of curiosity, epistemic curiosity, this love of knowledge, and love of information actually stays fairly constant with age. Because people ask me, they say, "Oh, but little children, they ask, "Why," all the time, and then it goes away. How did we kill their curiosity?" That's not actually true. What research shows is that, yes, that perceptual type of curiosity, namely being constantly surprised by things, and willing to take risks for novelty; that does decline with age. But, this love of knowledge, or

being infovores actually stays fairly constant throughout our entire life.

Roger: Mm-hmm (affirmative). Speaking of surprise, is the "aha" phenomenon related to curiosity, when I sort of make a little breakthrough in something?

Mario: "Ha ha," as in way of laughing? Or, "Aha."

Roger: No. No, no; "Aha." A-h-a.

Mario: Okay. Well, "aha" is usually a satisfaction of curiosity, right? I mean, you didn't understand something, and then you get some clue that immediately somehow clarifies the things. That's an "aha" moment, when you think you understood that; yes.

Roger: Right. Yeah. Because I'm reminded of some of the classic ads for Absolut vodka, when they had these sort of puzzle ads, where there'd be kind of an obscure shape that eventually your eye would resolve into a shape of an Absolut bottle. And in some cases, it was very obvious. But, they never showed the bottle itself full sized, the way most advertisers did. It was always some sort of abstract shape, where there was a shrubbery, or a swimming pool, something like that, that people would have to look at it, study it for just a minute to decode the information in there.

Mario: And that's actually, believe it or not, exactly the way some of the neuro scientific experiments on curiosity were done. There is this Dutch neuroscientist, [inaudible 00:28:55], and the way they have done this is that they have shown people blurred images of common objects, to make them curious about what those things were. And they just stuck the people inside functional MRI machines,

and looked at which parts of their brains are activated when they see these ambiguous shapes, which they try to figure out what they are.

Roger: Great. Well, I want to be respectful of your time, Mario. Let me remind our listeners that we're speaking to Mario Livio, author of the new book, Why; What Makes Us Curious. Mario, where can our listeners find you and your ideas online?

Mario: Well, there is my own website, which is Mario-Livio.com. I'm on Twitter; my handle is Mario_Livio, with capital M and L. I have a Facebook page, which is, again, under my name. And, of course, the book can be found anywhere that books are sold.

Roger: Great. Well, we will link to all those places and both your new book Why, and some of your past books, on the show notes page at RogerDooley.com/podcast. And we'll have a text version of our conversation there, too. Mario, thanks for being on the show. Really enjoyed the book.

Mario: Thank you very much for having me.

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