On Randomness & Choice
by On Being

Transcript for Leonard Mlodinow — Randomness and Choice

Leonard Mlodinow: When you look at your life, if you had to sit down and think about, and I'm talking about in detail, not just the headlines, if you think about all the details of what happened to you, you will find that there was a time where you had the extra cup of coffee, where if you hadn't, you wouldn't have met Person A. When I look back in my life, I could find so many instances like that. And I had fun tracing some of them. And the course of your life depends on how you react to those opportunities and challenges that the randomness presents to you. If you're awake and paying attention, you will find that things happen. They might seem good, they might seem bad but the important thing is how you reacted to it.

[Music: “Seven League Boots” by Zoe Keating]

Krista Tippett, host: Listeners to this show know that I interview a lot of physicists. And physicists will all tell you that the math we have right now doesn’t really make room for human free will. Fundamental forces of physics somehow determine everything that happens — as my guest today, Leonard Mlodinow has written — “from the birth of a child to the birth of a galaxy.”

I’ve been puzzling over this especially since my conversation with Brian Greene. And Leonard Mlodinow weighs into this puzzling in intriguing ways. He is a physicist ready to openly reflect on the gap between theory and reality — and the fascinating interplay

between a life in science and life in the world.

He’s co-written books with Stephen Hawking — and Deepak Chopra. He’s written for television — “Star Trek: The Next Generation.” And as the child of two Holocaust survivors, Leonard Mlodinow asks questions about our capacity to choose and create our lives while reflecting on extreme human cruelty — and courage.

I’m Krista Tippett, and this is On Being.

Leonard Mlodinow is the author of several books including The Drunkard’s Walk: How Randomness Rules Our Lives — and Feynman’s Rainbow: A Search for Beauty in Physics and in Life, about his friendship and study with the pioneering 20th Century physicist, Richard Feynman.

Ms. Tippett: Well, I'm just really happy to be sitting down to talk to you. I so enjoyed getting into your writing and your work, and I'm a huge Star Trek person, so we'll get to that. So it all just…

Dr. Mlodinow: Okay [laughs].

Ms. Tippett: ...is very exciting. So, I think I'm just going to, without further ado, jump in.

Dr. Mlodinow: Sounds good.

Ms. Tippett: Okay. What, now where did you grow up?

Dr. Mlodinow: I grew up in Chicago. Actually, in Evanston for most of my time in Chicago, which is near north suburb.

Ms. Tippett: Yeah. And, your parents were both Holocaust survivors, people who had separately survived the Holocaust, and then did they meet in the United States?

Dr. Mlodinow: Yeah, they met in New York. My father was in the Bronx then. My mother was in Brooklyn. And, somehow, despite that chasm, they managed to hook up.

Ms. Tippett: Yeah. And so, you know, this is just a question I always ask at the beginning of my interviews about the religious — whether there was a religious background to your childhood. Obviously, there was a Jewish background to your childhood. But, you know, was there any religious or spiritual substance left to your parents' Jewish identity?

Dr. Mlodinow: Well there was a very spiritual aspect of my parents, Judaism and the background as I was growing up. The religious aspect in terms of God was a bit mixed, because on the one hand, my parents often spoke about God as if God would do this or do

that, or shouldn't do this, or shouldn't do that. On the other hand, I remember my mother telling me once that she couldn't believe in God because if there was a God, the Holocaust could never have happened.

Ms. Tippett: Yeah.

Dr. Mlodinow: And what kind of God would let her whole family be slaughtered and so on. So, it was kind of a mixed message, but they were very attached to the cultural aspect of Judaism, and as I am as well.

Ms. Tippett: Yeah. And then you ended up, in your early 20s, on a kibbutz in Israel.

Dr. Mlodinow: Yeah, when the Yom Kippur War broke out, the government of Israel was asking for help. And, I was a — I think it was my second year of college. I can't remember now if it was the first or the second year. But I dropped everything, dropped out of school and went to Israel to work on a kibbutz. And it was a very interesting experience, you know, it was the first time in my life I could actually do something that was, you know, an act, a real act based on belief.

And secondly, the kibbutz was communist. So, it was extremely interesting to live under communism for that period. We all for instance, everybody ate together in a dining hall. The kids were taken away from the parents and raised in separate places...

Ms. Tippett: Right, right. I read about those.

Dr. Mlodinow: ...and their parents would visit them. And, yeah, when Passover came, and I don't eat bread and flour products on Passover, on the kibbutz, that was frowned upon that you — you were supposed to not observe Passover. And so we had to kind of sneak in the matzah. [Laughs] In Israel.

Ms. Tippett: That's so [laughs].

Dr. Mlodinow: So, there you go.

Ms. Tippett: Right. And you've told this story that it was there, you know, by way of a book by Richard Feynman that your imagination was captured by physics. I mean, tell me what captured you that then led you to go back and study this and ended up really becoming your vocation.

Dr. Mlodinow: Well, ever since I was very young, I loved mathematics and chemistry. Chemistry was really my first love in science. I had a chemistry lab in our basement of where we lived, and you know, had the usual experience of blowing up myself. [laughs] And, I was fanatic about it. I was passionate because I — it was my way of exploring the world of being able to do active things to — it was like a video game today, but everything was real, you know. It was that kind of a feeling. And when I was on the kibbutz, there was nothing to read at night. Of course, there's no TV or anything. We had a — I was in a little hut with another guy. But the kibbutz had a library with Hebrew books in it, and the only English books it had were these physics books by Feynman, which I assume was because someone there had gone to college in the states, and studied physics or had come back from college, or something. And Feynman, in those days, wasn't really known outside of physics. Today, he's really a cultural icon, I think.

Ms. Tippett: Yeah.

Dr. Mlodinow: But, you know, the physics I had in high school was very dry. And Feynman's approach was so quirky and interesting. I mean, and the textbooks didn't read like textbooks. They read like someone talking to you, and someone who has passion for a subject, and a love for a subject. And I felt that. And I really was inspired by that. And luckily, I got a job at Caltech after I got my Ph.D. and got to meet him. So, it was really a great journey.

Ms. Tippett: You know, there's this line that is near the end of — the beginning of the book you wrote about Feynman, Feynman's Rainbow. I mean, it's really your story, but it's interwoven with the story of his influence on you. And you wrote, "to be a physicist is to have an enormous potential to change the world." That's a very grand sentence and I just wonder how do you trace the origins of that sense in you, and also what did it mean, there, when you started to articulate that.

Dr. Mlodinow: Well, you know, I think I've always been inspired by my father's experiences. And, my father's just a normal person, a poor — grew up poor in Poland. I remember him telling about — once about eating roadkill and what a treat that was when they found a deer that had been killed on the road. And he was a tailor. He had a 7th grade education. And, but when the war came, you know, he faced, well, he faced horrors for one. He lost his wife and his child, most of his siblings. But he joined the Jewish Underground and his reaction to it was to try and do something about it. And, that really influenced me a lot, because I felt, you know, that time where he was striving for good, and putting himself out there, and you know, working really day and night, too, because he was like a slave laborer during the day for the Nazis. And then stay up all night doing their underground work. I mean, it was just a struggle, a struggle to, you know, to overcome the — what was there, and to change really bad things.

Ms. Tippett: You know, it's very striking. You, again referring to Feynman, but I think this comes through in all your writing, you know, you talk about, you know, you said this about him near the end of his days, that you found answers you sought about the nature of science and a scientist, but also you discovered a new approach to life. And I just wondered if you'd say a little bit more about the contours of that, the substance of that, that approach to life?

Dr. Mlodinow: Yeah. Well, the title of that book that I wrote was Feynman's Rainbow and that incident really, I think, illustrates things. Where we walking along and looking at a rainbow and he asked me what makes the rainbow. And I'm thinking about the physics of the rainbow. And his point was that the rainbow is beautiful because it's beautiful to behold and that there's a connection between — in physics, you have to follow your passion, and that's really what's important. Not the technical aspects of it.

And, when I was at — first got to Caltech, I thought about becoming a writer because I loved writing as well as physics. And I somehow wanted to be able to do both. I always felt I had to hide my writing, because physicists really frowned on it. You know, they were so focused and narrow in their field. And, Feynman really taught me that you need to follow your passions in life, if you can. I mean, not everyone has that opportunity. But if you can, it's best to follow your passions in life and that not just will that be more fulfilling, but you'll do better work.

And, when you look at physics problems, you have to look at it from that point of view, from the point of view of it just being a beautiful problem and you being excited about

trying to solve it. It's not just a job. And, you should try to live your whole life that way, if you can.

[Music: “An Ending a Beginning” by Dustin O’ Halloran]

Ms. Tippett: You know, one of the qualities that I actually would also say is a quality of your science writing, which is very unusual, is there's a playfulness, right?

There's a playfulness and a joyfulness about it. That's also — those are also words I don't think people necessarily attach to science in their imagination.

Dr. Mlodinow: Yeah, and I appreciate you saying that. And it's funny, because I don't aim to do that, but that's how I feel. You know, it's in there because when I write my books, even though they may be on a technical aspect of science, I — that's where I'm coming from, is a feeling of joy, or enthusiasm, or humor, or spirituality that I hope comes out. that I'm not writing a textbook, I'm putting me into my books.

Ms. Tippett: Yeah. Yeah. So, you also, and I suppose this could be associated with playfulness, although for many people it's deadly serious, you wrote [laughs] you have written for Star Trek. [Laughs].

Dr. Mlodinow: [Laughs] The Next Generation.

Ms. Tippett: The Next Generation, which is the best of the series, right.

Dr. Mlodinow: That's what I think.

Ms. Tippett: Okay. I never get to have this conversation…

Dr. Mlodinow: Coincidence, I think not.

Ms. Tippett: …with people. Everyone says, oh, they grew up loving Star Trek, fine, yeah, but the one that really mattered was Star Trek: The Next Generation. But, you know, for you, I think to be a writer of — it's like a Trekkie version of, you know, a 13th century rabbi encoding Talmudic wisdom for the generations, right? [Laughs] You're one of the creators.

Dr. Mlodinow: Yeah, you mix the Talmud, a little Klingon, and you've got something that's kind of interesting.

Ms. Tippett: Exactly. [Laughs]

Dr. Mlodinow: And hopefully you learn something along the way.

Ms. Tippett: Yeah. And I mean, you tell this funny story about, I don't know, I can't remember where you told this, maybe this — a lovely piece you wrote in Newsweek about that, which we'll put on our website. You know, somehow coming into a conversation with an attorney quoting from Klingon history, and you listen and you're tuning out, and then you somehow realize that it was something you had written. It was an episode you'd written.

Dr. Mlodinow: Yes. [Laughs] And I'm thinking, oh, okay, I vaguely remember that at first. Oh wait a minute. That was me. And that was part of the fun of Star Trek, because when you wrote stuff, people paid attention, which is always fun.

Ms. Tippett: Yeah, right.

Dr. Mlodinow: It meant something to them. And the good thing about the season, well, about The Next Generation, and especially the season I worked on it, was that we really, I think, treated — tried to treat big questions.

Ms. Tippett: Yes.

Dr. Mlodinow: One episode that was one of my favorites was about whether Data is a sentient being, because Data's a computer, but Data's a really intelligent computer, who acts like a human. And what's the difference then? So we tried to explore questions like that, which was the fun of it, I think. And that's why, I think it had a broad appeal to a lot of very — otherwise very scientific or intellectual people who would still appreciate watching Star Trek.

Ms. Tippett: Right. So I went back, knowing I was going to interview you, and I listened again to a piece of an episode from The Next Generation that actually we played in one of the very first shows I created, like, and this was like 10 or 12 years ago, really before the weekly show. And I wonder if it was from one of those series you worked on? It's the — it's Commander Data, who was an Android, who was always so trying to understand what it was to be human and in a way, in his Android way, striving to be human. Where he asked Dr. Crusher what is the definition of life.

He wrote it's just this beautiful moment, he says, I'm curious — he asks her for a definition of life. She gives him a definition of life. And he says, what about me? I do not grow. I do not reproduce. Yet I'm considered to be alive. And then he says, I'm curious as to what transpired between the moment when I was nothing more than an assemblage of parts in Dr. Soong's laboratory and the next moment, when I became alive. What is it that endowed me with life?

Dr. Mlodinow: Wow, that's one of those eternal questions, too. I don't remember if I worked on that or not. It just may be like the attorney story. Maybe I wrote that.

Ms. Tippett: Yeah.

Dr. Mlodinow: But the question is certainly one that I've thought about, and it's a very deep question, because I think having a character like Data really underlines, underscores that, because you can argue with a biological organism what is life? Or what's the difference between a human and a bacteria? Or a human and a

grasshopper? But when you say a pile of silicon and does it become — what point does it become a sentient conscious being is a very — is a question, of course, we have no answer to. But I think that we shouldn't dismiss the possibility of Data being alive because he's not biological. And neuroscientists today are only beginning to understand consciousness. I have a friend, Christof Koch, who works on that, and we've had many debates. But he believes that all information processing systems are conscious to some extent. Even a thermostat. [Laughs].

Ms. Tippett: Really?

Dr. Mlodinow: Any system that takes information and integrates it, he would say is conscious, and it's all a spectrum, from zero or epsilon, a very tiny amount, to, you know, a great amount that we have, or perhaps even a greater amount that you might find somewhere else in the universe. And, they're trying to form mathematical scientific theories of it. But it's really very hard. I don't think we even have a good working definition of what consciousness is.

Ms. Tippett: Yeah.

Dr. Mlodinow: So it's the very, very early stages. I think — I believe that science will address that question eventually. But, we're not ready to do it yet.

[Music: “Ping” by Hauschka]

I'm Krista Tippett and this is On Being. Today: physicist and author Leonard Mlodinow.

Ms. Tippett: So, I had a conversation with Brian Greene and that still has me thinking and we ended up talking a lot about something that I know is a given for physicists, and it's there in your writing, although I think you nuance it in interesting ways. And I want to get into this with you. Which is, no scientist in any field claims to be able to predict or understand human personality or destiny, but most physicists do believe fundamentally that nothing happens in the universe that is not the result of fundamental forces and laws of physics. I mean, you've wrote this from the birth of a child to the birth of a galaxy. And that is just a really stunning and puzzling fact. [Laughs].

Dr. Mlodinow: [Laughs] Yes. And, I could give you a monologue for hours about that, but I'll try not to.

Ms. Tippett: Well, I mean, let's just have a conversation about it, because I haven't been able to really stop thinking about it, puzzling with it. And as I was reading, getting ready to talk to you, I realized you're a perfect person to talk to this about. I mean, where would you start talking about that as a puzzle?

Dr. Mlodinow: There are a lot of aspects to that question. Maybe the most basic one is really comes down to are there miracles? Meaning exceptions to the laws of nature. Or does everything follow physical law? In a way that's the essence of the question. You know, Isaac Newton, when he invented his physics, which is to say the beginning of modern physics, the physics of the everyday world, he believed that everything followed his laws without exception, except that God steps in now and then, and sets things straight when they start to go awry.

Ms. Tippett: Right. Right.

Dr. Mlodinow: So he believed in some kind of limited miracles. Pierre Simon Laplace, who proved that the solar system is stable, was very famous for saying something that he actually semi-stole from a Catholic priest. But his statement — very famous statement is that if you know everything, the state of everything now, and you know all the laws, and you have infinite calculation ability, then the future and the past are both determined. Neither is hidden from your knowledge or from your eyes. And so when Napoleon asked him why there was no God in his science, Laplace said, I have no need for that hypothesis. [Laughs].

Ms. Tippett: Right.

Dr. Mlodinow: If you believe that there are no exceptions, whether they be big miracles or minor deviations from the laws of physics, whether you look at the quantum laws that are fundamental or Newton's laws. Whichever laws you look at, neither set of laws has room for deviations or choice, let's say. Conscious choice. So, if you believe that the brain follows those laws, as everything that — in the laboratory that we've ever looked at, does, then it's not a question for scientists.

Ms. Tippett: But the totality of our lives and circumstances at any given moment is the result of so many more — like we imagine choice and we imagine we have an intuition of purposefulness. Or the need for that. But one thing that was very striking to me about, you know, getting into the way you think about this is, I think, one thing I said to Brian Greene, you know, his title — his book title that's so well-known is The Elegant Universe and you physicists use that language of elegance and beauty together with truth, right, in terms of, you know, the equations that are true are elegant and somehow this picture of the laws of physics being as tyrannical as any medieval God was…

Dr. Mlodinow: [laughs]

Ms. Tippett: …this is what really troubles me. At the extreme edges of talking about the laws of physics this way, you could just substitute the way the most primitive human cultures have used the word God, and we are so reduced.

Dr. Mlodinow: Well, this is interesting, because now we're coming to the difference between theory and practice. [Laughs]

Ms. Tippett: [Laughs] Yeah.

Dr. Mlodinow: And, the idea that we have no free will is an interesting philosophical question. In reality, we do have free will. Because in reality a system as complex as the brain with 100 billion neurons and I think 1,000 to 10,000 connections between each of them on average, is so complex that not only could one say that one can't, in principle, model it or predict exactly what it's going to do next, but almost in principle you can't. Because in very complex systems, small changes in the state of the system produce large changes in the output.

Ms. Tippett: Right.

Dr. Mlodinow: It's called — that's called chaos. But that's typical of very complicated, non-linear systems. And...

Ms. Tippett: The human beings are...

Dr. Mlodinow: ...the thing about the brain is...

Ms. Tippett: ...I would say every human being...

Dr. Mlodinow: ...that even...

Ms. Tippett: ...every human being is a complicated, non-linear system. [Laughs]

Dr. Mlodinow: [Laughs] Yeah, hey the ones I know are.

Ms. Tippett: Yeah.

Dr. Mlodinow: Of course, not me, I'm very straightforward, and logical, and always right. [Laughs]. But other people are like that. And, when you look at their brain, there's no way, even if you put the equations of physics, It's an infinite possibility. And with something as complicated as the brain, I believe that errors in these measurements are always going to ruin your predictions. So in physics you have these things called effective theories, which are saying okay, there's some other theory underneath it, but that's too complicated. This one works. And this, but we're still even going farther and saying almost in principle that the brain is too complicated to apply Laplacean determinism and so, the free will that we feel that we have is really — does defy the God as you say, the rulers or the despots of determinism. [Laughs]. So that's just another way of looking at it. That's probably as far on the spectrum toward free will as most scientists are willing to go.

Ms. Tippett: Right. Well, I mean, and let's just bring it down to earth. You know, your father, resisting the Nazi's in Poland, if you took this blanket statement that there is no choice, there is no free will, somehow this was all determined by forces beyond our control or comprehension. Your father's life there and his action meant nothing, and had no nobility, and no meaning, and there's just something — everything in, I don't think just me, but most scientists as human beings, would rebel against that thought.

Dr. Mlodinow: Well, to me, even with my own view of free will and feeling that the laws of nature don't have exceptions, what my father did, or what anyone does, is meaningful. Because if you think of this way, that he's a biological organism that I don't know his — the layout of his brain or how that produces whatever he does, so I judge him by his actions. And what he was doing with those heroic actions was revealing

who he was. And, there are other people who revealed who they were and, you know, it wasn't, in my mind, as attractive of a person. [Laughs]. So, I don't think that there's a difference between he's on the spot making a decision do I take the fall for this or do I try to blow up that or whatever his decision was, is any less heroic if the decision was meant to be based on who he is as a person.

Ms. Tippett: Mm-hmm. I mean, it raises the question of whether there is such a thing as courage, or maybe it's just that our definition of courage is like isolated acts, but...

Dr. Mlodinow: Well, of course there's...

Ms. Tippett: ...you're saying maybe it's...

Dr. Mlodinow: ...or maybe the courage is who you are. And the courage isn't that decision at that moment, the courage is that you're the kind of person who would make that decision.

[Music: “Oblivion” by Ahn Trio]

Ms. Tippett: You can listen again and share this conversation through our website — and you can hear that favorite clip of Commander Data there too — that’s onbeing.org.

Coming up, Leonard Mlodinow on why, even in a deterministic world, our responses to what happens to us matter.

I’m Krista Tippett. On Being continues in a moment.

[Music: “Oblivion” by Ahn Trio]

Ms. Tippett: I'm Krista Tippett and this is On Being. Today with the physicist Leonard Mlodinow. He’s reflecting with me on the puzzling dissonance between our human sense that we choose and shape our lives, and the scientific observation that free will is an illusion.

He is a child of two Holocaust survivors, and someone who’s written books with figures as diverse as Stephen Hawking and Deepak Chopra. He’s been sharing the nuanced way he reconciles his life experiences with modern physics faith in randomness.

Ms. Tippett: I find a bit of an opening, also, in the way you think about this and the way you write about randomness. So here's something you wrote and I think these two things went together. I mean, you write about your father's — a story he told you about how he got the job in the bakery at Buchenwald, the concentration camp. His sense that this is just random but tell that story.

Dr. Mlodinow: Oh, that was in The Drunkard's Walk.

Ms. Tippett: Yeah.

Dr. Mlodinow: And the book is about randomness and life. And to me, you know, when I was thinking about writing that book, I was almost shaken by the realization that I'm, you know, a random effect of something very bad. And I hope that for me, I'm glad I'm here, but I'm only here because Hitler or the Nazis killed my father's previous family. And that led to my being here.

Ms. Tippett: Yeah.

Dr. Mlodinow: And that was a very hard to thing to face, in a way, that — what's the meaning of my life, when it arose from something like that? And in that story, he was in the Buchenwald concentration camp, and he had stole — he stole a loaf of bread from the bakery. And, the baker, I guess there were a certain number of people who had access. They lined them all up and brought the guys with the guns. And they said who stole the bread? And my father didn't say anything. And then they said, okay, we're going to start at this end of the line, and we're going to shoot everybody, until either you're all dead or the thief steps forward. And so he puts the gun to the head of the first person. So my father, at that point, steps forward, and admitted that he stole the bread. And, he told me that it wasn't a heroic thing that — he didn't do it out of heroism, he did it surely practical that these guys are all going to die, and I'm going to die, too, or I'll just be the only one. So he stepped forward. And instead of killing him, though, the baker acted like God, and somewhat arbitrarily took him under his wing and gave him a job as his assistant in the bakery. And so, he had a much better job after that, based on that incident. And it just shows you that even in the midst of all this cruelty, there's randomness, or I don't know what, whim? I don't know if the guy — I don't know if he was being human and let some of his humanity peek out, or he wanted to play like God, I don't really know what was the person's motive, but that's one of many things that happened to my father. If it had happened differently, I wouldn't be here, and my kids wouldn't be here. And everything would be different in, you know, that lineage.

Ms. Tippett: You know, one of the things that's so fascinating is how quantum physics has presented a picture of the world that is so much more of reality, the way things work — that is so much less ordered, more — there's chaos, there's randomization, and it wasn't there for Newton or even for Einstein or they didn't want — you know, Einstein didn't want those things to be there. And, you know, one of the things you say is anything that is possible eventually will occur. [Laughs]. Just wait long enough and strange things will happen. But still, there's an

order to it.

Dr. Mlodinow: Doesn't your life work that way? [Laughs].

Ms. Tippett: Yeah. [Laughs]. But here's the out I — here's the opening I feel you give. Here's something else you wrote. "The outline of our lives, like the candle's flame, is continuously coaxed in new directions by a variety of random events that, along with our responses to them, determine our fate." You know, you say that we are driven to see patterns and create patterns where the patterns aren't there, but essentially there's so much randomness. But, you — seems to me that you're also presenting our responses as mattering. There is randomness, and then you talk about that even though that is true, you know, the number of at-bats, the number of chances taken, number of opportunities seized does make a difference. It does shift things. Can you explain that in scientific terms?

Dr. Mlodinow: [Laughs]. Yeah, I was thinking about Brownian motion, so that says it all.

Ms. Tippett: [Laughs].

Dr. Mlodinow: No, I'm just kidding [laughs]. The — so The Drunkard's Walk, which is the title of that book, is sometimes called The Random Walk and it comes from a jagged path that particles in Brownian motion seem to take for no apparent reason. In Brownian motion, people look at — this in the 19th century, they noticed that little grains of pieces of pollen would jiggle around for no apparent reason in liquid. And they thought at first maybe that was a life force, because there was no force on it. Maybe that's what was jiggling, because it's pollen. But they eventually figured out, and Einstein actually is the one who explained it, that this jiggling comes from the impact of the molecules on the pollen, pushing it this way and that way. And I saw a parallel with our lives, because when you look at your life, if you had to sit down and think about, and I'm talking about in detail, not just the headlines, if you think about all the details of what happened to you, you will find that there was a time where you had the extra cup of coffee, where if you hadn't, you wouldn't have met Person A.

Ms. Tippett: Yeah.

Dr. Mlodinow: Or you probably don't realize that if you hadn't done this, you would have gotten into crash which you — car crash but you didn't, because you were a little bit later than and the guy — the drunk guy hit someone else or whatever. When I look back in my life, or I looked at the life of certain celebrities, I could find so many instances like that. And I had fun tracing some of them. How little things make a big difference, and — but the little thing that happens to you, other than if it's something random like getting hit by a car, but in other ways, the little things that — what they really do is they raise opportunities for you. Or they raise challenges. And the course of your life depends on how you react to those opportunities and challenges that the randomness presents to you. So that's what I meant by that. That if you're awake and paying attention, you will find that things happen. They might seem good, they might seem bad at first, you don't even know. Or you're wrong about whether it's good or bad. But, in time, it becomes clear whether the thing was good or bad, but the important thing is how you reacted to it.

Ms. Tippett: And, how is that acceptable for you as a physicist in a way that the notion of free will is less convincing? I'm just trying to figure out what the distinction is.

Dr. Mlodinow: Well, if I were to describe your every atom, then there wouldn't be this randomness. I mean, there is still quantum randomness, which I don't — I think just as a red herring here, but randomness is really a context-dependent term. So imagine you're flipping a coin. That's one of the archetypical random event in our culture. We always flip a coin. And it comes out, if it's a fair coin, 50/50. But actually if you control very carefully how you put the coin on your thumb, and how you flip it, and where it's going to land, you can — it's not really random. It's going to come out heads every time, or tails every time. So, whether it's — the coin flip is random or not really depends on what you know and how much control you have. And so what I'm saying about life is you don't know a lot, even if you think you do [laughs] and you don't have a lot of control, even if you're a control freak. So a lot of things that happen to you in that sense are random and the same thing with your reaction to it. Yes, maybe a god-like person who knew what the state of all the atoms in your body could tell how you're going to react, but since none of us are that, it really does matter, and you do have a choice. And that determines your life.

Ms. Tippett: Okay.

Dr. Mlodinow: It doesn't sound like you're very satisfied, though, I think.

Ms. Tippett: No, no. I just wonder, I mean...

Dr. Mlodinow: Hmm, another scientist answer, ha. [Laughs].

Ms. Tippett: [Laughs] Well, I feel like this could be a few hours, but I mean, I do hear, I mean, the words...

Dr. Mlodinow: So, the quality of your voice tells a lot, doesn't it. [Laughs]

Ms. Tippett: [Laughs] Yes, it does. It does. I just wonder if there's a vocabulary thing here. Do you know what I mean? Like that the notion of free will doesn't work for science, but, I mean, you used the word choice, and I suppose that would be subject to some debate, but I feel like there's a way in which you're saying, you know, that what we do matters. Although you might say it, and describe it, and see it in a very different way that humanity has said that kind of thing up to now. Knowing what we know now about the universe. Is that fair?

Dr. Mlodinow: Yeah. I definitely think that my decisions matter.

Ms. Tippett: Mm-hmm.

Dr. Mlodinow: Now, it's more of a philosophical question, I guess, whether I was destined to make that decision.

Ms. Tippett: Yeah.

Dr. Mlodinow: In my life, that question doesn't — is something to ponder at times, but the effective theory is that yes, if I step off the building, I'm going to fall off the roof, and bad things will happen. And I don't know whether I was destined to decide not to step off or not, but I take the decision as if I have a choice.

Ms. Tippett: Mm-hmm.

Dr. Mlodinow: And I think you have to live your life that way. And no one — whether or not you can argue that theoretically there's a choice or not, no one knows enough to tell you what choice you're going to make.

Ms. Tippett: Right. Right.

Dr. Mlodinow: Not even yourself, I think.

[Music: “Halcyon” by Jon Hopkins]

Ms. Tippett: I'm Krista Tippett and this is On Being. Today: physicist and writer Leonard Mlodinow.

Ms. Tippett: There's a way in which this thing that physics is pointing out and that you point out in your books and on — they subliminal, the way our subconscious is kind of influencing us in ways we aren't aware of and randomness. I mean, you — there's a way in which that pointing out how little control we actually have over so much of what happens to us is a piece of truth that the spiritual traditions have carried forward in time. And that philosophy has known for a long time. I also sense that there's — the way you take that in, even the science of it is that's real power in that knowledge. Does it change the way you kind of move through your everyday life knowing about your lack of control? I mean, how does that — how do you work with that as a human being?

Dr. Mlodinow: Well, certainly it does change, I certainly don't mean to say that the unconscious is not you and there's someone else [laughs] pulling the strings.

Ms. Tippett: Yeah, yeah.

Dr. Mlodinow: But what we don't realize is how much of our feelings, our actions, our beliefs, are coming from our unconscious mind. And I think that when we raise our consciousness about our unconscious, you're knowing yourself better and to know yourself better, I think, is a good thing. You understand how you're going to react, and you understand why you did things. And you just have more understanding for yourself. So it not only helps you make in a way better decisions, economically, but it helps you make better decisions, I think spiritually, because you have, in a way, more tolerance for yourself, as well as more understanding.

Ms. Tippett: And you write interestingly and very poignantly about your mother also in this

regard? I mean, you know, you talk about how the extreme horrible experiences she had of losing just everyone she loved meant that she totally had to relinquish the illusion of control that most of us walk around with, you know, some sense of control. But you talk about how, you know, one of the things you say about her is that current events don't get to her. Right?

Dr. Mlodinow: Yeah. But she has her own context for everything. That was a big thing I noticed growing up, for instance, we used to talk every Thursday when I was in graduate school. Every Thursday night I would call her. And then one Thursday I don't call her, so she calls and talks to my roommate. And my roommate said, oh, Len is out. And my mother, okay, fine, okay. My mother calls back in half hour. Where's Len? Len is out. And she just starts calling back. He's still out? How could he still be out? Something happened.

Ms. Tippett: Right. Right.

Dr. Mlodinow: Why don't you tell me what happened? And the reason she saw it that way I think had to do with the fact that she had everything suddenly taken from her. Her friends were killed. Her parents, her siblings died, and she had — that was her — part of her context, and from then on, she would think of possibilities when she'd see something happen, that you and I would not think of.

Ms. Tippett: Right, right.

Dr. Mlodinow: And that's in her unconscious. She didn't want to think that way, but that was — to her, that was very real. I remember telling her, mom you should go see a psychologist or a psychiatrist, because you have this weird way of interpreting everything. And you're always fearful. And she thought she was normal. She said, no that's crazy. I'm just — I'm normal. I said don't you think that your Holocaust experiences affects you? No. No, I've gotten past that. And then I don't call her, and she thinks I'm dead, so...

Ms. Tippett: Right. There's a sense in which her reactions were rational, given the context in which she was reacting.

Dr. Mlodinow: Yeah, and we all have our context, so...

Ms. Tippett: That makes our reactions rational, yeah.

Dr. Mlodinow: ...we all approach the world — we all think we're rational, we all have our past history that we're, you know, maybe some of us are trying to get past or not, but this colors the way we interpret everything that happens around us. So, it's — to me, it was a very interesting lesson.

Ms. Tippett: Yeah.

Dr. Mlodinow: To learn that the reality that I see is biased, and it's biased by however I grew up and whatever has happened to me.

Ms. Tippett: So you mentioned the dialogue with Deepak Chopra and I took a look at that, and I guess I'll just maybe ask you was there anything that came out of that that, did it affect your thinking — did it invite you to articulate some things, maybe, that you hadn't quite articulated in that way before?

Dr. Mlodinow: Oh, definitely. It focused me on purely spiritual issues for the time that we were writing the book. And I have to say he is a zealot. I mean, he is so passionate about his beliefs that we did a book tour after the book came out. We were together for six weeks. And he didn't stop trying to convert me in taxi cabs [laughs], Grand Central Station, and you know, he converted me in some ways. I had meditated before I met him, but through knowing him, he taught me really how to meditate and it, that really seemed to be a great thing in my life. And we sat on an airplane and meditated together, we sat in Penn Station, New York, and mediated. And at the same time, we would be arguing about physics, so so what it did was it really focused me on spiritual issues for that time and it caused me to think about questions that I often, in the science, didn't stop and take time to think about. So, for me as a person, that was good. And in writing the book, I think I spent a lot of time trying to criticize the way that he was using science. But I also spent time expressing that science can be spiritual, and that it doesn't have to be — really, the War of the Worldviews title was really a bad title...

Ms. Tippett: Yeah.

Dr. Mlodinow: ...that it doesn't have to be a war. And we both regretted the title afterwards. But, so, I think that was a good experience.

Ms. Tippett: When you say science can be spiritual, you know, what is that sentence mean for you? Like, break that up — open for me.

Dr. Mlodinow: Well, it means that we can think of who we are as human beings. We can value the emotional part of life. We can value the looking inward at who we are, how we fit in to our community and also to the universe as a whole. And I think that knowing science just adds to that. To me, trying to figure out my place in the world without science would have been very difficult and, in a way, empty. To me, the way I view myself as a natural phenomenon, is a comfort at times. Certainly it's a comfort at times of grief and death. And it's also, you know, inspiration at times that atoms within me that are interacting based on these simple laws, and then you throw in zillions of them and they are jiggling around together and interacting with each other, create my thoughts. That is amazing. And, you know, only someone who studied science can really appreciate how amazing and how wonderful that is. And it means how wonderful I am, which is always a good thing to realize.

Ms. Tippett: [Laughs]. You had an intriguing sentence in your — in the dialogue with Deepak Chopra. You wrote "Belief, too, can be a working hypothesis." Do you remember that?

Dr. Mlodinow: I do. I'm trying to remember now what the context was.

Ms. Tippett: Well, the context was you were kind of wrapping up and you were talking about how you had been in a sense arguing against this proposition, or certain proposition of belief. But you described a friend, someone I think you respected, who talked about what her faith, her belief, you know, what — the positive function that it served in her life. I felt like you were saying, this is a way that you as a physicist could frame the notion of belief as something that you leave on the table. That belief, too, can be a working hypothesis.

Dr. Mlodinow: Right, so a working hypothesis is something that you — that may or may not eventually prove true, but it's useful to you at the time, and it's just as

well be true.

Ms. Tippett: Yeah.

Dr. Mlodinow: And what struck me about that person at dinner was that she was someone that I really respected, and respected as being very rational, and even scientific. And then I was surprised when she talked about believing in God and the soul and this spiritual part of religion that seems outside science. And, then as she told me, though, how it helped her in life, and I think also brought up a story about a person in the Holocaust who was facing death, and how the people among the people facing death, those who had faith fared better.

Ms. Tippett: Yeah.

Dr. Mlodinow: And then I realized that religion can be a working hypothesis, so whether or not I believe eventually, ultimately, that it's true, I realize that if people feel that it's true, then it can be a good thing to believe in. And you know, related to that, I also had a revelation — I shouldn't use the word revelation [laughs] but an insight...

Ms. Tippett: [Laughs] A miracle?

Dr. Mlodinow: No, no, I didn't have a revelation, please. I had an insight that I have beliefs that are not scientifically-based, too, and I believe them. And I can't help but believe them. And they're totally irrational and I admit that I have that and it helps me understand other people's thinking, as well.

Ms. Tippett: You also said to me at the very beginning that Judaism was important to you. That, I don't know if you meant Jewish identity, Jewish tradition, ritual.

Dr. Mlodinow: Yeah, all of that.

Ms. Tippett: Yeah.

Dr. Mlodinow: The values, the emphasis on education, the culture, the history, and I think I don't want to speak for everybody, but for me, having a thousands of years history and knowing something about it, helps me know — understand my place and who I am.

Ms. Tippett: So, my last question, I want to ask you a question that you describe asking Richard Feynman. And it was who are you as a person, and how has being a scientist influenced your character?

Dr. Mlodinow: Oh, wow, yeah, I remember that.

Ms. Tippett: Yeah? Your turn. [Laughs].

Dr. Mlodinow: [Laughs]. I don't remember his exact answer...

Ms. Tippett: No, no, you're answer. I don't want to know what...

Dr. Mlodinow: Oh, my answer.

Ms. Tippett: You're answer.

Dr. Mlodinow: Yeah, because he asked me. I was going to say, he asked me that. I don't think — did I answer it in the book? Because I remember not answering him right away.

Ms. Tippett: No, no, I think you asked him the question...

Dr. Mlodinow: And he told me I should answer the question.

Ms. Tippett: Oh, okay. So now, I am coming back...

Dr. Mlodinow: Typical of — my answer...

Ms. Tippett: I'm channeling Richard Feynman here in 2014...

Dr. Mlodinow: The channeling Richard Feynman to me.

Ms. Tippett: ...who are you as a person and how has being a scientist influenced your character?

Dr. Mlodinow: I think that I am a person who believes in passion, and believes that we have a limited time here, and we should all try to make the best of it. And, do the best for ourselves while not hurting other people. And that it's good to, despite having a spiritual side, it's good to understand rationally everything that's going on around you, both in the interaction of human beings, and the structure and the evolution of the universe. That I think that having the scientific knowledge of where the universe came from and who people are only helps you to appreciate who you are and who we are as human beings and how we should act.

[Music: “Hope Valley Hill” by Helios]

Ms. Tippett: Leonard Mlodinow is a physicist and the author of several books including The Drunkard’s Walk: How Randomness Rules Our Lives and Feynman’s Rainbow: A Search for Beauty in Physics and in Life.

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[Music: “Hollisday” by Shawn Lee’s Ping Orchestra]

Ms. Tippett: On Being is Trent Gilliss, Chris Heagle, Lily Percy, Mariah Helgeson, Chris Jones, and Joshua Rae.