Reach Out and Read Podcast Transcript:
**“**The Disappearance of Insight**”** with Frank Keil

Dr. Dipesh Navsaria: [00:00:00] Reach Out and Read, where books build better brains. This is the Reach Out and Read Podcast. I'm your host, Dr. Dipesh Navsaria, a practicing pediatrician with degrees in public health and children's librarianship. I'm a clinical professor of human development and family studies at the School of Human Ecology and a professor of pediatrics at the School of Medicine and Public Health, both at the University of Wisconsin in Madison. At Reach Out and Read, we dream of a world in which every child is read to every day. Our show explores how children and families flourish and thrive through a combination of individual well-being, confident parents, supportive communities, strong public health, and good policy. Join us here for thought-provoking conversations on these issues with expert guests, authors, and leaders in the field of early childhood health and literacy. Research shows that reading physical books together brings the strongest benefits to children. That's why we're happy to have Boise Paper, a responsible paper manufacturer, as the founding sponsor of this podcast through their paper with Purpose Promise Boise Paper looks for ways to make a difference in local communities. Thank you to Boise Paper for investing in our Reach Out and Read community. When I was younger, I have to admit I wasn't a child who spent a lot of time taking things apart. But one thing that I really relished learning was computer programming. I learned the very basics of how to make a computer do things, even if it was just simply making a little square move around on a screen. I loved being able to dig in and easily see how computers did the things that they do.

Well, that world has gotten a lot more complicated. And I have to say, it's been a long time since I've been able to do that. It's not as easy for a child today to take apart a digital watch, a phone, or see how WiFi or the internet works, and share in that same sense of wonder and discovery. Advances in technology have put the inner workings of everyday artifacts around us out of sight. As our next guest writes, the recent decline of revealing mechanisms in children's lives provides an opportunity to better understand how all of us adapt to changes in explanatory resources and to shifting areas of understanding, rather than neglecting and even actively refusing to think about gaps in our explanatory understandings. We can see how an awareness of those gaps creates an empowering form of intellectual humility. Sharing

that humility with the younger generations may be one of the most important ways we can help them prepare for the future. Frank Keil is the Charles C. and Dorothea S. Dilley professor of psychology, as well as professor of linguistics and cognitive science at Yale University. He received an NIH Merit Award, has been a Guggenheim fellow and a fellow at the center for Advanced Study in Behavioral Sciences. His new book is "The Disappearance of Insight: When Technology Undermines How and Why." We last had him on our show to talk about his book, "Wonder, Childhood, and the Lifelong Love of Science." Listeners can go back into our library to find that episode, and we're thrilled to have him back on our podcast. Frank, welcome again to the show.

Frank Keil: [00:03:21] Well, thank you for having me. I very much enjoy your show. So, I'm glad to be on.

Dr. Dipesh Navsaria: [00:03:23] Thank you. So, your new book in some ways is almost like a sequel to "Wonder," and you wrote that insights wouldn't happen without a drive to ask "why" and "how." This drive can be described as "wondering." And when nurtured and supported, it can lead to a life of exciting discoveries. But wonder alone cannot yield insights. Let's start. What's the difference between wonder and insight?

Frank Keil: [00:03:52] Well, what struck me —and I alluded to this in the "Wonder" book —but it really came to me as I thought about later. We don't —the whole cycle of wondering and learning doesn't work if the world is not felicitous, if it doesn't help us. And as I started looking around more and more, the things I had as a child, what my children had and what kids today have, I realized that it's becoming radically opaque, that you can't see what's going on. You can't decompose things. You can't intervene on things and change things. And so, as a result, wondering is kind of a futile exercise. Kid opens up something expecting to see how it works — explain something. It doesn't happen. And so, we don't know exactly what the consequences are, but it's such a sweeping change and one that's often ignored. If you look at objects in the 1960s and today, they are radically different. And the crazy thing is, while this has happened with artifacts and devices all over the place from a different vantage point, it's happening in AI because there's these large computer systems that get built up. They don't —we don't —understand how they work. When you talked about initial programming, that was a relatively simple thing we could do as mechanical metaphors. I remember in the early course I had programming. They talked about pushdown stacks, and they used analogy to cafeteria trays in elementary school, but it took a play to try it out and it popped out.

And so, that was a very mechanical metaphor, easy to understand. That's not available to us today. So, that's our concern. And we know that it's reflected

in language. People don't talk about mechanisms. They don't search for mechanisms. They often search for how to use things. They become users rather than understanders. And I think the cost is huge. I think one of the most wonderful things about knowing stuff and explaining stuff is you see the world much more richly and deeply. I always love to learn something new. That makes the world look different to me. I mean, I come to love the seasons, especially recently because I'm learning more about why flowers adapt in certain ways —why they change, why leaves fall off trees, how that's choreographed with temperature, and the length of day, and all that makes it just a richer experience. It's like living with color vision versus not. So, I think having one dissatisfied, developing causal expectations and understandings just makes life richer and more fun. And it gives you more sense of being involved. But it does, as you mentioned, also require a sense of appreciating ignorance. It's fun to find out something you don't know. You shouldn't be sad when you don't know something. You should be delighted.

Dr. Dipesh Navsaria: [00:06:11] Yeah. No, you know, my own young adult children, they first started, you know, using computers and devices. Right? I realized that they had absolutely no idea what was under the hood of these devices, even though I don't know how to program them myself at this point. Right? I have some idea of, right, how these black boxes work on some level. And that's something that I think most younger people don't necessarily appreciate these days unless they are actually in computer science or programming.

Frank Keil: [00:06:45] You can't blame them. It's very hard. And even the ones in CS often skip over that. It's a tough dilemma. I mean, I'd like to convince kids, and I think with our sons, we've more or less done that — that there's a great virtue in learning those mechanical kinds of innards and how things work. Even old TV sets, which were electronic, worked in a very transparent way. But today it's impossible. And so, I think that shift —you don't need to know it all, but you need to understand what's happened, and you understand how to access it. Outsourcing skills, the ability to get access to information, are much weaker if you don't have some rudimentary knowledge structure to use. Sure. And without that basic framework, you're in trouble.

Dr. Dipesh Navsaria: [00:07:22] You're also validating an approach I take actually with all of my students, but my undergraduates in particular, where I tell them that we're not really here for you to learn the answers. You're here to learn how to ask good questions. And I think being able to ask good questions, I think it gets really to that. Let's be curious about things and try to take them apart. Even if we don't get to, quote unquote, the answer in the end.

Frank Keil: [00:07:46] I've been teaching a seminar for the last few years where they're not allowed to bring any notes or take notes — no computers in the room, no phones. And one of the projects I've done in every class is describe something that knew nothing about, completely out of their expertise, as best they can. "Explain why it works, whether it be GPS or metamorphosis in a butterfly." And then, "say what?" They still don't know. "Where are the gaps?" "What did they do to rectify them?" And I interrogate them. And then I say, "what did you learn here about what you know and don't know?" "How good were you at medicinal?" They find it incredibly illuminating. They've never done that before. And so, knowing what this whole enterprise is about and appreciating not knowing and helping each other out. Then, I often have them debate about issues and they don't know what side they're going to take. It's the same kind of thing —thinking on your feet, developing shared knowledge, drawing on what you know is very important indeed.

Dr. Dipesh Navsaria: [00:08:34] Indeed, you had written that "insights are typically embedded in wonder-driven, fed-feed cycles that consist of puzzling, hypothesizing, exploring, and discovering." Can you walk us through what that cycle is in more detail?

Frank Keil: [00:08:50] Well, when you puzzle something, you see preverbal elements to this. You come across something that doesn't. I'll give you an example from Lisa Ferguson's work at Johns Hopkins. An infant watches a ball coming towards a barrier and seeming to go right through the barrier. So, they're very puzzled. And they said, "I wonder what that could be." "Maybe there's something that allows them to go through." "Let me look." And then, they turn around and look. And if they find a hole, this is the most interesting part. If she makes it so they can see a hole, they stop exploring. They're done. They sort of nod and they go on to something else. If they can't find a hole, they keep going. They get frustrated. So, that's it. The discovery happens if the world affords it.

Dr. Dipesh Navsaria: [00:09:28] Mhm. Yeah. Is there something about childhood that primes us for both wonder and insight?

Frank Keil: [00:09:35] Yeah. I don't know what it is. It's been — it's extremely strong drive, I think. And I think in the "Wonder" book, I talked about how there are a lot of reasons it gets sort of shut down. Our educational system doesn't really invade. It doesn't really take into account what kids want to know. Big classrooms do it. I talked to someone from Japan recently who got interested in this book. He was telling me the average class sizes there are 35, and they're really worried about how to keep the kids engaged and have these conversations. But I think, getting back to all cultures, parents need to

be, I think, partners in discovery and illustrate their own humility. They have to —they can't act like it's not asymmetrical. They're much more like the kids than not, except the kids are much less nervous about asking why. The sad thing is that they hit elementary school. The "why" questions plummet —sometimes, people, from 50 times a day to nothing. And you can blame the teachers. They got a lot of kids in their class. They got a lot of things to do, and the tests don't test it. Even the PSA test, for all its vaunted greatness, rarely gets causal explanations. It gets the things like the scientific method, which frankly, I found boring compared to knowing why and how.

Dr. Dipesh Navsaria: [00:10:40] Sure. Yeah, it is. I mean, again —reflecting on my own teaching with professional students and also undergraduate students —is that there's this fear of being wrong. Right? And I have to actually go out of my way to invite people to make guesses and tell them it's absolutely okay to guess because that's what I'm looking for.

Frank Keil: [00:10:57] I try to use the analogy to coming to a new park and exploring it, and you come around the corner and say, "this isn't what I expected at all," and that gets you excited because you want to explore it —not, "oh, I'm so embarrassed that I didn't know what was around the corner." It's that kind of a thing. It's rewarding.

Dr. Dipesh Navsaria: [00:11:11] Indeed. You wrote about the difference between functional information and mechanistic information. Can you explain what that is?

Frank Keil: [00:11:20] It seems very clear, and it is. But as I start to blend, the rough idea is that how do you use something? How do you turn off and on? How do you do as a user interface versus how do you know the underlying properties that give rise to what it is? The reason I'm hedging a bit is, when you get deeper and deeper into the function, there's a subfunction. Subfunction starts to become mechanism. But there are some classic examples of reverse engineering where you describe something —you know, its mechanism. You don't know what it's for. But those are rare, happen mostly in archaeology. Usually, we get the function first and then we try to unpack the mechanism. Function is easy and it's useful, but without knowing the mechanism, you're often at the mercy of others. If they say "it just doesn't work," you need to fix it. They could overcharge you and stuff. There's all sorts of problems and it's hard to innovate, but I'll say this is what people think they can do. They have to surrender to that because they can't do anything else. I don't believe it, but that's what I think.

Dr. Dipesh Navsaria: [00:12:13] Sure, I imagine many people suddenly gravitate towards a mechanistic mindset when they become a homeowner and realize how expensive it is to fix.

Frank Keil: [00:12:21] Well, they would like to, but it's complicated because many utensil makers and appliance makers don't care to make. There's this whole "right to repair" movement. Interestingly, it's very powerful in the agricultural communities because this farming machinery costs like a million bucks or more. And if you're a guy living on a shoestring, you can't have them down there. People come out and fix them. You have to fix it yourself. And so, they actually have more mechanistic knowledge — many farmers and people work on farms than many, because they have to. I think true for many fishermen. So, we'd like to do more repairs, but it's not easy. I asked my kids and my seniors how they can change a car tire. My daughter didn't have no idea how to do it. A few things they do, and they would kill themselves. So, that's really a little bit scary to me.

Dr. Dipesh Navsaria: [00:13:06] Mhm. Indeed. You argue that children have a predisposition to a mechanistic mindset. So, what do you —any observations as to why and how we beat it out of them?

Frank Keil: [00:13:21] You know, I think I'm not sure of this, but I think it's because objects —artifacts, we build them —aren't just there. They reflect the contours of our own mind. You build something. You're going to build in a way that's easy to assemble, easy to remember, easy if it breaks down. It has stable subassemblies. I was Herb Simon's point years ago. And what that means is that they're easy to apprehend. So, we build artifacts in ways that resonate with kids. Secondly, mechanisms allow kids to intervene more easily. They can touch something and say they can tinker and tinkering is a very satisfying activity. I think it's important for children to do this because that's where innovation comes from. And so, it's "why do they like it so much?" It's just obviously satisfying, like I talked about earlier with the wall with the hornet. They get very excited when they realize they've seen something they hadn't seen before. It's like perception, except it's conceptual perception.

Dr. Dipesh Navsaria: [00:14:17] Yeah. I wonder if it's also something to do with the relative development of like, you know, both gross and fine motor skills compared to like some of the cognitive elements that that may take longer to develop —that it's more accessible to them in some way.

Frank Keil: [00:14:31] That's interesting. Yeah, its form of understanding of the world is very spatial. So, you can see things, forces pushing and pulling. And for a variety of reasons, we think that's very cognitively basic. You know, the method of loci. We try to remember a bunch of objects, and you walk around

your house and you put them. You can do your speeches in a Roman forum based on that. You can expand your memories greatly through spatial layouts. Right?

Dr. Dipesh Navsaria: [00:14:56] The memory palaces.

Frank Keil: [00:14:58] And most mechanisms are spatially laid out. So, you can use that as a powerful cognitive prosthesis. So again, that's the reason why mechanism is informative.

Dr. Dipesh Navsaria: [00:15:07] Sure.

Frank Keil: [00:15:08] It allows you to pose counterfactuals more easily. You say, "what if this piece was missing?" And then, suddenly, all things come to mind.

Dr. Dipesh Navsaria: [00:15:14] Sure. There was, you know, you were talking earlier about parents and children. And there was a point early in your book where you talked about "complementary cognition," which I thought had some interesting implications. You noted that we often cover for each other. This is true of adults as well as —you know, parents and children when we have lapses in knowledge or skill. And you said, "children are unaware of how much of their daily cognitions rely on subtle daily cognitive scaffolding by their parents." So, I would imagine that has implications for what happens when relational interactions are being crowded out by device-based interactions.

Frank Keil: [00:15:58] They think they can do a lot more on their own than they really can. And we have a study we did —MIT, Richardson and I —where we showed that, you know, they think that they're totally capable of doing something when in fact, if you leave them on their devices, they can't at all. Now, in some ways that might be a good thing because it gives them optimism. It gives them a chance to try. Christie Lockhart has some research showing that having an optimism that's maybe not fully appropriate gives you more motivation. But I think it's important for kids to want to try. And so, that's one reason why they probably do it.

Dr. Dipesh Navsaria: [00:16:32] Mhm. Yeah. But again, I would imagine that if children are not getting that relational scaffolding from parents —right? Like, do devices interfere with that?

Frank Keil: [00:16:44] They could, especially if it's a badly designed device —like many modern toys are mechanistically at odds with how the real world works. One of my sons has an electronic saxophone he gave his kids, and it

works exactly the opposite of saxophones. The more holes that are covered, the higher the pitch goes and all sorts of crazy things. So, that can happen if you have no parents to help you. They could. The frustration could enter in. So, parents as guides can be something, but they have to be not all-knowing guides, but partners and say, "let's figure this out together." I think the best thing you can do as a parent simply reading a book or something is to interact with them and say, "this is weird." "I don't like —how can we figure this out?" And show that you're in the same boat. You're just a little farther along in some respects.

Dr. Dipesh Navsaria: [00:17:24] Yeah.

Frank Keil: [00:17:25] Yeah. So, I don't think they are discouraging, if you could help. You're right. It isn't really complicated. No one's helping you. You just might give up.

Dr. Dipesh Navsaria: [00:17:32] Yeah. And I note that you said in that, "cognitive scaffolding, not cognitive takeover by the parents."

Frank Keil: [00:17:37] No, that's very important. It's very important to know that you need help, but you're also an agent. I mean, one thing I talk about in the book a lot is keeping your own cognitive agency, not being subordinate to everything. And you can make a difference.

Dr. Dipesh Navsaria: [00:17:55] And that strikes me as like, that's a lot of what we try to do in programs like Reach Out and Read, like home visiting, etc., right, is helping parents hit as best they can that sweet spot of engaging and providing some scaffolding, but not completely doing it for children either.

Frank Keil: [00:18:11] It's hard. Yeah, it is. And I think people forget that you have to really engage the kids. You can't be looking at your cell phone all the time. This is a cliche, but it's true. Nothing drives me crazy — going to parks or elsewhere and watching science museums, watching a parent look at their cell phone more than engaging with their child. And it's a way of going, "what's the point?" I don't even think they're watching television. You should never have a kid just watching TV alone. You should watch it with them. You should interpret what's going on. It's not a place to park the kid. And certainly with reading, that's the whole game? Sure.

Dr. Dipesh Navsaria: [00:18:45] Now, further on in the book, you talk about the importance of intellectual humility. Can you say more about what that is and why it's important to nurture that trait in children?

Frank Keil: [00:18:57] It's complicated because you might think "why?" They feel bad about their ignorance. But as I tried to say earlier, not knowing something can be a source of delight. You just have to understand what that means. If it's something you really should have known and you're just defiantly not knowing it for some reason, that might be a problem, but much of the time you just say, "oh, I should have known that." That's fine and a friend should not really kill you. You should definitely, as parents, stand up for your kid. If someone says, "you didn't know that!" Right? You know, but I think I tried to say earlier, it's like discovering something new that you can learn about. That'll be fun to play with. It'll provide you with new insights.

Dr. Dipesh Navsaria: [00:19:30] Yeah. I'm reminded of in medical training we talk about a phenomenon that, I mean, it happened to me and it happens to other people —that, you know, the student doesn't know why something's going on with a patient. They bring it to the resident. The resident doesn't know. They bring it to the fellow. The fellow says, "oh, gosh, I don't know." And then, finally, you get to the senior attending, right, with the most experience and you present it and they scrunch up their face and go, "that's really interesting." "I'm really not sure why we're seeing this phenomenon." And everyone gets relieved. "Oh, good —they don't know!"

Frank Keil: [00:20:06] That's a great story and it's exactly right. Hopefully the people who are the most knowledgeable are the most. It's often said they know the most. They know more about ignorance than anybody, than the more things they don't know, the more you know. And I think that can often be true. Yeah. One of my sons is a doctor, and he's certainly —the more he gets into this profession, he says, "oh my God, it's so complicated!" Yeah. Or there's just so many mysteries we still have to solve. So, yeah. And he said, "it's a challenge." "It's interesting."

Dr. Dipesh Navsaria: [00:20:30] Yeah. There's a curve that I've seen of the further you go in your training and education and experience, the more you realize that we don't know all that much.

Frank Keil: [00:20:39] But you also become better at figuring out what is knowable, likely what is going to be probably very hard to go after, who to seek out. You get a sense of the terrain, a sort of meta knowledge. And I think that's very important. You don't need to know everything. You just have to get a sense of "who should you talk to?" "What's likely to be very hard to learn more about?" "What's easier?" I will say I'm impressed by the new AI agents, because often when I want to unpack something, I'll go back and forth with them and dig deeper. But that only works if you know quite a bit. If you go into some novice questions, it's a disaster. They flatter you to death. They tell you you're doing all the right things and you're doing all the wrong things.

But if you use them with a cynical eye, with a more sophisticated eye, they can be quite useful for the same thing.

Dr. Dipesh Navsaria: [00:21:21] Yeah. Well, it goes back to what I was saying earlier. Right? Like, how do we teach people to ask good questions?

Frank Keil: [00:21:27] Yeah. And I think I say, "ask about clauses." "Ask about mechanisms." If you want to know whether someone's BSing you, asking them to unpack mechanism, even if it's in a domain that you know almost nothing about usually traps the fakers. They can't keep at it. It doesn't mean that the experts will know all the mechanisms, but when they say they don't know, it makes sense.

Dr. Dipesh Navsaria: [00:21:46] Right? Yeah. So, you talk about the mechanistic mindset and you offer seven strategies to maintain that. And I thought we could very briefly kind of go through each of those. So, your first is just you say "start young."

Frank Keil: [00:22:02] I think because these kids are so eager to learn about mechanisms early on, you feed them. Let this grow. It's not going to just happen. It happens. There's this framework, but it has to be built upon just as visual experience does —muscles, whatever you want to take development as, finding out what kids are naturally good at and helping them grow. Give them the right fertilizer.

Dr. Dipesh Navsaria: [00:22:19] Your second was to focus on causal patterns.

Frank Keil: [00:22:23] Yeah, don't be factoids. Don't be. You know, it's like the worst and best of jeopardy. The worst jeopardy is when you have these dippy facts and the connection to anything. It's more interesting when they say something that implies some reasoning. And life is something you don't want to accumulate facts that disappear. But learning something that generalizes and gives you new insights to new situations, that's the fun thing. And that's usually causal.

Dr. Dipesh Navsaria: [00:22:45] The third one struck me as like a heavier "have your cake and eat it, too" phenomenon. Go both deep and broad.

Frank Keil: [00:22:52] Oh, this is complicated. I really wrestled with this, but I'm pretty convinced it's the right approach. There are some people who say "go incredibly broad at the top level." They call it "range," just know a little bit about everything. But the danger with that is that you become kind of a dilettante, and you're very subject to people like influencers who pronounce something. And how do you disagree with them? You have no way to argue

back. So, that's a problem. But going super deep, becoming a hyper specialist, I see this in medicine all the time. People who get so narrowly specialized in something, like corneal repair. And I don't even know ophthalmology. And so, you can get so pocketed down that it becomes very hard to figure out what's going on. And when you get border cases or boundary cases, it's no fun. My dad was a very good surgeon, but he confessed at times to getting bored, the more specialized he got. It's the same thing, again and again. So, I think what you need to do is get some sense of the terrain of knowledge very broadly, but dive down deep enough a few times to know what it means to go deep, not in all the details —just to know so you can understand how expertise is distributed, where the great challenges and joys of life is knowing the terrain of knowledge, the divisions of cognitive labor, how they're structured horizontally and verbally, vertically —and then, be able to access it. So, that's why I think you have to go both ways.

Dr. Dipesh Navsaria: [00:24:07] Yeah. And I really like that because you specifically talked about, you know, you can be both a generalist and a specialist. Right? At the same time, these are not exclusive. And I actually was like, "yeah, that's actually a great description of how I try to approach things myself." Right? That "be broad." "Be general." But that doesn't mean that you need to be superficial either.

Frank Keil: [00:24:26] I mean, it's hard because you can't do it in depth, but you can pick one little thing and go down quite deep just to know what it feels like. Yeah.

Dr. Dipesh Navsaria: [00:24:34] Your fourth was "maintain multiple perspectives."

Frank Keil: [00:24:38] Oh, this is I think also very important. You can interpret things through different mental models. And by the way, the mechanistic causal view is what makes models easy to construct. I'll do a digression here in a second, but to get to this point, every model you build —whether it's mechanistic, or psychological, or functional, whatever —is a distortion. You can't take all the complexity of the world and think about it at the same time. So, whenever you take a perspective on something, you're going to leave out other things. But if you take several perspectives on something like think of a person as an agent, as a biological creature, as a physical object, and you start to emerge a more full sense of what they're all about. So, that's the important part of it. It's very controversial now in many of the sciences, including psychology. People are saying it's been kind of a conceit over the years to think that we can have three way models of how the world works, its thousands of variables, hundreds of thousands. And they say, "get rid of models." "Just predict." It's sadly happening in medicine where people are

saying, “let's do bespoke medicine for each person, personalized medicine.” What that often means is making massive tests, looking at all the variables and —God knows why, but —we'll get in this drug machine. And so, I think that's not a good strategy to do. I think it's no fun and it makes you helpless. So, I think we have to understand how to use models, but understand that they distort. They're always one philosopher called “felicitous falsehoods.” You have to understand why we have to make certain assumptions —but what the insights are and what the costs are.

Dr. Dipesh Navsaria: [00:26:06] Indeed. Your fifth we've touched on: “know what you know and what you don't know.”

Frank Keil: [00:26:13] It's not as easy as it sounds because there's, you know —I could easily learn this. I just have to dive a little deeper. But this may be something really hard, even for me or for the discipline. I mean, quantum mechanics is a great example. I've talked to some leading quantum physicists who say, “I know the math, but I still can't wrap my head around it.” I can't sort of do it like a mechanism of how a differential in a car works. It just doesn't congeal. And so, that's interesting to know. They know that they're going to be some way of intuiting it. They're just not going to have. And then, they're going to have to put up with it or maybe master it someday.

Dr. Dipesh Navsaria: [00:26:44] Indeed. Your sixth was “learn where ideas come from.”

Frank Keil: [00:26:48] Oh, this is a personal thing, but I —in my “Wonder” book, I talked about a science teacher who I had who taught all science in elementary school from prehistoric times to the present. And somehow, he did it in real time. And I think knowing how ideas originated first makes it much easier to understand them. But secondly, it makes it more motivational because early on you can sort of get it and it gives you a sense of how they're formed and what the human component was. I've been trying to understand more about thermodynamics. It's one of the spookiest and funniest areas of the sciences and how it evolved in the 19th century. And I got to go through it historically because it's so complicated. But if you take it historically, you start to see where it's going. I love Michael Faraday because he was not very mathy, but he was exquisitely a good observer and had mechanical models. Then, Maxwell came in, and even though he was famous for his math abilities, he always went back to the mechanical model. So, it's interesting to see how that worked, because it gives you a sense of how you should take your own learning theory. It's not that history recapitulates learning and development, but there are parallels and they're interesting to see. Yeah. And I think it's just much more fun. Yeah. I'm very sad because many scientists don't have the

time for that. But I've seen the good teachers. It doesn't take any more time. It's just a different way of doing it.

Dr. Dipesh Navsaria: [00:27:58] Yeah. You know, when I teach one of my classes in clinical medicine and public health, I actually walk our students through kind of prescientific method —you know, germ theory, etc., — how we went from kind of basically superstition to what we call medicine today, which is not that long a period of time. Right? But if you understand where we came from and recognize those changes, it helps you understand the structures we have better and sometimes understand that they might not be the best structures, but they evolve that way because of these transformations that occurred.

Frank Keil: [00:28:34] What did I talk about? My book is how we incredibly underestimate how long it took for most things to happen. If you were these TV shows where people in the wilderness and they said, "whoever survives the longest wins," most of the time the winner is the guy who doesn't starve first, who they don't really. Because if you try to grow stuff you've got in the woods, it's usually not nutritious enough. It took hundreds of generations to get good seeds. That's why there are these seed banks up in the Arctic. And so, we always underestimate how long it takes things to happen. Something as simple as I was reading this morning about car differentials, because I was trying to remember how they worked and I had some gaps and they looked at the evolution of them was really complicated. The wheels start spinning at different speeds as they went faster. How do you compensate for that? It's a wonderful story. And so, I think we have this foreshortening bias both in our own lives. We think we did it quicker than we really did, but especially historically.

Dr. Dipesh Navsaria: [00:29:28] Sure. And then, your last strategy, which I just loved: "keep humans in meaningful loops."

Frank Keil: [00:29:34] Oh, yeah. This is really important because there's a lot of talk about keeping people in loop in AI. But if you look at most of the programs in AI and what it means to keep in loop in their parlance, it means to say, "I'm enjoying this," or, "this is an easy interface to use," or "I'm discouraged here." That's not what we mean at all. By keeping loops meaningful, loops is what can we offer that is not available in the current AI. I've stopped saying "I'll never be able to do this" because I've been wrong far too often, but I still believe that you need to them to hear what you care about —why it's important to you. And there is one thing that may be true: the latest AI's, even the ones that are really big, are starting to build in mechanical models of mechanical physics, mechanical folk psychology. Because while it may be true that with acres and acres of data centers they

can get what they need, sometimes it simplifies the problem by a factor of 100 or 1000 to give us a little model boost. I think it's potentially the case that in a few years they'll say, "we can't make this work without making it more like human minds by building in various biases and models that they can use." Because even with all their power, it's not enough.

Dr. Dipesh Navsaria: [00:30:46] Yeah. And I enjoyed how much you also just talked about, you know, the cognitive abilities and nuances that humans bring that, who knows, maybe we'll get there with AI —but it's not clear that we necessarily will.

Frank Keil: [00:31:00] They're pretty terrible with counterfactuals and I think that's interesting. They're pretty bad with analogies. They often make really bad analogies. There's some things they don't. When you —I just heard a talk today about mistakes they make. There's a cute one where you tell them these riddles that are very stereotypical, like this guy says, "I can't operate on this person." "He's my son." And the trick is that it's really a female surgeon. They get that totally because it's everywhere. But you tell a different way and they totally miss it. So, they still do things that we don't do, but the scary thing and the frustrating thing is people keep improving them by adding in kluges. So, they're not really how they work systemically. We've got to correct for this problem. So, I find every new generation of AI, it doesn't make the mistake you did last week, not because it's in principle working better. It's just they've done a patch, which makes it hard to understand, which is too bad.

Dr. Dipesh Navsaria: [00:31:46] Yeah. They still don't get it. It's just a patch.

Frank Keil: [00:31:48] Exactly.

Dr. Dipesh Navsaria: [00:31:49] Sure. Well, Frank, you know, I think it would have been so easy —in a sense, right —to just simply say, "oh, yeah, you know, AI is not as good as the old fashioned, you know, methods, etc.," and leave it at that. And instead, with this book, there's just so much that you've built here —built on in terms of your work, other people's work —about children, about humans, and really kind of applying this whole concept of both wonder and of insight to make this case. Because again, your subhead is "The Disappearance of Insight." The subhead is "When Technology Undermines How and Why." It was a delight to read.

Frank Keil: [00:32:32] Well, thank you. You notice I put one in there very carefully because I didn't want people to think it must do this. We have to be prepared for when it could do this and know how to respond. Right? And so, when I talked about titles, they wanted to leave. I said, "no, I don't want a

dystopian disaster book." "I want to talk about this as something we should deal with."

Dr. Dipesh Navsaria: [00:32:48] Yeah, exactly. Well, thank you again for both this book and for this conversation. Really appreciate it.

Frank Keil: [00:32:55] Thank you. It was a great pleasure. And thank you for reading the book so carefully. It's nice to see.

Dr. Dipesh Navsaria: [00:33:03] Welcome to today's 33rd page or something extra for you, our listeners. Our guest's book today ended in a really remarkable way, and I somewhat selfishly decided not to bring it up during the interview because I wanted to just read it out loud to you. He says, "we have repeatedly seen how insights allow us to see more deeply and act more effectively. These are intrinsically rewarding experiences that enrich our encounters with the world and give us a greater sense of efficacy. These alone are ample reasons for wanting to preserve opportunities, for discovering the causal underpinnings of all that exists and happens around us. But perhaps most important are the ways that understanding and explanation support two basic human rights: the right to know why and the right to know how. When we simply accept the supposedly inevitable rise of the unexplainable, we may be giving up far more than we first imagined. The right to know why is widely endorsed, but difficult to consistently respect. Every person is entitled to understand why decisions affecting them are made. Setting aside limits imposed by factors such as community security and the ability to grasp even the simplest explanation (e.g. young infants), we see individuals and groups as obligated to explain to us the reasons behind actions that affect us, whether it is being fired from a job, excluded from a press conference, or being urged to wear masks. Decisions should be justified in an honest and transparent manner that allows and even invites further questions and discussion. Young children sense this right when they request explanations for actions. We should support and nourish the exercising of that right in a reasonable manner. When machines undertake actions or make recommendations supposedly on our behalf, we should not easily give up the right to know why a machine came to that conclusion. We may choose to waive that this right in special cases, but we should at least be aware of the possible consequences in doing so. The right to know how is becoming more visible in areas such as the right to repair movement. We are entitled to have access to accurate and understandable explanations of how things operate. This includes not only the right to know how systems, technologies and institutions work, but also the right to know when no one understands how something works. While acknowledging intellectual property and security concerns, we should not accept excessive use of those concerns to manipulate individuals. When cars show a sharp jump in prices because of the

purported increase in expense of new technologies, we should be able to see whether those new costs are justified or were merely a pretext for increasing profits. If a computer company introduces a new model that no longer allows any user repairs or upgrades, we are entitled to object to this abridging of her agency, unless it can be shown that the new model could not be economically produced without rendering previously serviceable components inaccessible, enabling consumers to intervene on systems should be a manufacturer's default obligation, not a possible option. In the end, we must appreciate how much deep insights are uniquely human gifts. Our dog, no matter how clever and manipulative she is, has no right to know why and how. But our grandchildren do. Even those still in infancy, only humans experience the thrill of insight and the pleasures of seeing so much more, at least for now." And that's today's 33rd page. You've been listening to the Reach Out and Read Podcast. Reach Out and Read is a nonprofit organization that is the authoritative national voice for the positive effects of reading daily and supports. Coaches. and celebrates engaging in those language-rich activities with young children. We're continually inspired by stories that encourage language literacy and Early Relational Health. Visit us at reachoutandread.org/podcast to find out more. And don't forget to subscribe to our show wherever you listen to your podcasts. If you like what you hear, please leave us a review. Your feedback helps grow our podcast community and tells others that this podcast is worth listening to. Our show is a production of Reach Out and Read. Our producer is Jill Ruby. Lori Brooks is our chief external affairs officer. Thank you to our founding sponsor, Boise Paper, for making a difference in local communities like ours. I'm your host, Dr. Dipesh Navsaria. I look forward to spending time with you soon. And remember, books build better brains.