Scott Hanselman: This is ACM ByteCast, a podcast series from the Association for Computing Machinery, the world's largest education and scientific computing society. We talk to researchers, practitioners, and innovators who are at the intersection of computing research and practice. They share their experiences, the lessons they've learned, and their own visions for the future of computing. I'm your host today, Scott Hanselman.

Hi, I am Scott Hanselman. This is another episode of Hanselminutes on behalf of the ACM ByteCast. This joint podcast is a cooperation between ByteCast, the ACM and my podcast Hanselminutes. And today, I'm chatting with Dr. Rosalind Picard. She's a scientist, inventor and engineer. She's a member of the faculty of MIT's Media Lab and the founder and director of the Effective Computing Research Group at the MIT Media Lab and the founder of several companies in the space of Affective Computing. How are you?

Rosalind Picard: I'm well, thank you. How are you doing?

Scott Hanselman: I'm doing okay. I'm trying to be present and when people say like, how are you? That's a question where you have to go, "Oh, I'm fine." That could just be the nice social thing that you say, or you could go and say, "The darkness persists, but so do I." Or, "I'm feeling this way, I'm feeling that way." Being in touch with your feelings, it requires a lot of introspection. I wonder if I want to sit down at my computer one day and have the computer ask me how I am and then maybe disagree with me. Is that something that I want? It could say, "Well, I don't know. Are you okay?"

Rosalind Picard: Some want it, some don't, and it may depend very much on how you're feeling that day.

Scott Hanselman: It seems like how we interact with computers can very quickly enter what I call the uncanny valley of AI, where everything's amazing and it's getting better and better, and then it's like, oh, that's creepy. How do you, when deciding what a computer should know, what an algorithm should understand, when does it reach like, that's wonderful and joyful and delightful, and that's not okay. You shouldn't have known that about me. Do you think about those things in your research and work?

Rosalind Picard: Oh, yes. Yeah. We've backed off from some research where it felt too creepy or too worrisome or where talking to people about the misuses of the technology made us pause and say, "We don't have a good way to prevent that one yet. Why don't we just not develop that yet?"

Scott Hanselman: How do you decide on that? How do you measure that? Because I know we're talking about things like responsible AI, but there's a feeling of, I don't know if I want to interact with a piece of hardware with an algorithm in that way yet until we try it. But once you've proven that it can be done, that means that

unscrupulous people or others could choose to do that. And what can we do as consumers? I guess the only thing I can do is vote with my feet.

Rosalind Picard: Voting with feet is really powerful. Voting also with dangling something, it's not really voting. It's distracting with something that's better to do, I think is sometimes even more powerful, right? Like, yeah, you can work on that, which we're all worried might not be a good thing to do, or here's a better thing to work on. This is even more challenging. It's even more interesting and it has incredibly good ways. It could be improving people's lives. So distracting from an iffy topic to one that we also find hard and challenging and fun and interesting, but really important for people's lives is I think, a good strategy also.

Scott Hanselman: So the group that you founded and work in is the Affective, Affective, Affective, A-F-F, and people may be hearing effective and we want to call that out. Can you talk about what an affect is? Because this is not the effective computing group. It is the Affective Computing Group.

Rosalind Picard: Well, as the founder of our lab said in the early days when I proposed it, he said, "Affective computing? That's nicely confused with effective computing." And hopefully, it is effective also. But the original naming of it was me trying to avoid the word emotion. I thought emotion would ruin my career, and I really wasn't interested in emotion initially. I thought that was something that made us irrational. It was undesirable. That's the last thing we wanted to get near machines.

One of the great things about machines was they weren't emotional, but as I studied the human brain more and more and realized that the intelligence, the flexibility, the ability to adapt to complex, unpredictable inputs in the human brain was involving these emotion systems and that they were actually helping us be more rational, more intelligent. And I thought, oh dear, I need to figure out how to combine this with machines but not call it emotion. So I named it Affective Computing with an A. And initially, affective meant that included all kinds of things emotion, but it turns out it's a bigger umbrella term that has emotions under it, but also has other things that theorists argue whether or not they're emotion. But I include them in affect. Things like feeling interested, things like feeling motivated, things like feeling bored, things like feeling frustrated. None of those were on the emotion theorist emotion lists when I started.

Scott Hanselman: One of the things that I've always enjoyed about computer science is the naming part, and I have many great memories of working at places like Intel or Nike 20, 30 years ago, sitting around with a thesaurus trying to find the right word. And when you find the word, you're like, "Yeah, that's it. That's the noun that we're going to use for this object." And now this system just falls out. And while affect may not seem initially intuitive, the more you dig into it, the more the mouth feel of affective computing, it just works. It's an expression of

emotion. It's gestures, it's postures, it's voice. It's the vibes as the young people might say today.

Rosalind Picard: Yeah, you got it. Very good. Every now and then, we hit upon a name that actually works. I was working at the time in a group that we had just named Perceptual Computing, and so that two word, try to come up with something short that covers a lot was influential, but actually, it turns out perceptual computing needed affect and cognition. It needed to understand the brain in a more complete way than the cognitive scientists had been describing about it. And actually in fairness, some of them had said affect was a part of cognition, but I realized affect was more embodied than a lot of the cognitive theories that sometimes you can just wake up with a bodily state that makes you feel a little irritable or anxious or something. And we don't fully understand why that biochemistry and physiology affect our feelings like that. And then the cognition of it seems to follow the feeling in some cases.

And then in other cases, we just think about emotions and the emotions really are cognitive like Marvin Minsky would say to me in the days when I first started doing affective computing and he was writing a book called the Emotion Machine. He'd say, "Well, aren't emotions just another thought?" And I said, "Well, they can be a thought, but they're not just another thought."

Scott Hanselman: And Marvin Minsky, of course, the co-founder of the AI laboratory at MIT, and he is now late, but did a lot of work in the space of cognition. Now, you make an interesting point when you call out, there's the expression of one's affect, and then there's also the what's happening inside. If you wake up on the wrong side of the bed and you're like, "I don't know why I feel weird today, maybe I'll feel better tomorrow." There's the emotional part like when you asked me at the beginning, how are you? I did an internal inventory. But then there's my temperature, my blood sugar, all of the things that I may or may not have measurement of that might have direct or indirect effect on my affect that I can't necessarily measure. How much is this about emotions and things like that? And how much of this is about measuring these other parts of our bodies, these health indicators, heart rate, temperature, blood sugar.

Rosalind Picard: Yeah, it's a great question. When I first started working on affective computing, I'm trained as an electrical engineer, and my background's really computer architectures and signal processing. So I was thinking about emotion as a signal, and I wasn't quite sure how to get the signal initially. It wasn't just wirelessly coming out of my feelings into the computer. So I started exploring what is this anyhow? Do I have to draw blood? Do I have to plug something into my gut? Do I have to go invasively in the brain? And I started with what I could get.

I started with multichannel, physiological measurements because there had been a little bit of work suggesting that emotions influence your skin conductance, your heart rate, your muscle tension. So we started measuring everything we could get a sensor to stick on our bodies with. This was in the

early days at the media lab in the early '90s when Steve Mann and Thad Starner were there wearing amazing computers that they had been building. And so it was easy to wear a computer and attach all of these sensors to our bodies. So we'd have 50 pounds of wearable computing on us, walking around with antennas on our heads and collecting this physiology while getting the context around you, which is really important too, so that you could tell the difference between if your heart rate was going up because you're walking faster, or if your heart rate was going up because you were holding still and somebody's approaching you that looks very threatening.

Scott Hanselman: As a personal point of note that you might find interesting. It might be of use for this conversation. I am a 30-year type one diabetic, and as such, I've been with my open source community on the forefront of "wearable computing", but only in the context of I have an open source artificial pancreas. So I have an insulin pump embedded in my arm. I have a Dexcom, but I've been putting that data along with my open source cohorts in databases. So I have a Mongo database with the last 15 years of my blood sugar, and over the last 10 years with continuous glucose meters, I have every five minutes, 24 hours a day for the last decade or so of my blood sugar.

So one time I took information from Microsoft Outlook, which has an API and my blood sugar and I correlated which meetings were raising my blood sugar. And I have this demo on YouTube where you can see that my most stressful meetings, if blood sugar is a leading indicator of stress in some way, is this particular vice president at the company, that every time I go to a meeting with this person, this guy-

Rosalind Picard: That is so cool. Wow. I would love to add some of our other sensors to what you're doing. I've been wanting to do exactly that. Actually, I had borrowed a CGM for a very stressful series of events just to look at exactly what it sounds like. You already know personally.

Scott Hanselman: Was I doing lay persons or poor man's effective computing without realizing, and I was trying to figure out the correlations between these two possibly uncorrelated variables?

Rosalind Picard: Yeah, absolutely. And I want to hear more about what you learned from the stress and the glucose because my understanding is now with the technology, we can see what works for each individual and to what extent this is a group thing or there's great individual variation, but definitely, stress raises the blood sugar and sometimes, eating more sugar with that is actually the worst thing to do.

Scott Hanselman: Yeah, indeed. So in doing that, I was starting to think about the quantified self, and then I learned that there's a movement called the Quantified Self Movement, just like folks like Steve Mann was running around wearing all kinds of sensors. There are conventions. I've had folks from the Quantified Self

Movement on the show. Is it by observing though, are we not maybe adding to the cognitive load? There is talk right now of maybe that the Apple Watch may not be a great idea because it's causing people to be paranoid and overly aware of what's going on, by observing it, we've changed it.

Rosalind Picard: There certainly are cases where people may, for example, they want to improve their sleep and then looking at the device and looking at their sleep, they can get more anxious about not sleeping well. Next thing you know, they're lying in bed going, "Oh no, I'm not going to be able to sleep," which is the number one cause of insomnia, happens to be fear of not being able to fall asleep. It can be that without proper coaching around these, the devices can exacerbate some of the problems. They also, with proper coaching, like learning that you can handle those fearful thoughts with, hey, what's the worst thing that happens if I can't sleep? Okay. So I just lay here and rest all night with my mind awake. Usually, once you let go of that anxiety, you're asleep. So there's just more to be learned around it. How to use them. They are not a silver bullet. You just put this on and suddenly, your health is better.

Scott Hanselman: Yeah. The reason I ask is that in the space of the type one diabetics, I'm a person with a non-working pancreas. I feel strongly that having a continuous glucose device has a lot of value to me. But now, because we are a small market, there's only a small percentage of us, the people who sell these sensors are now selling them to fitness influencers and selling them to whomever. But the regular folks, regular Joes and Janes out there, they may not be familiar with how easily the Y axis can be used to make someone feel like something is happening, that it's not. The great statistical lie of the Y axis.

So I'll see normally blood sugared people be it, "Oh, your blood sugar is spiking because you ate a grape." And then again, it changes their emotion and it becomes this cycle of like, you don't need this. And to the point of the Apple Watch, it is a one lead EKG. If you actually get a heart EKG, they're going to be a seven lead. It's does it have value? So the question I'm going to ask you is that, how accurate does this stuff have to be, whether it be a camera or a sensor because building these both at the electrical hardware perspective and in the algorithms on the other side. And I'm curious, how do you think about accuracy?

Rosalind Picard: It's a great question and it varies a lot depending on the use case. When we're say working with a kid on the autism spectrum and just trying to help them understand that this feeling they've been having their whole life that they maybe didn't have a name for might be related to their skin conductance going up. And if they could learn to sense that going up before they explode, they might get an early warning indicator and be able to do something to self-regulate. That, a few micro semen in the signal is not a big deal. It's just learning where they are relative to their daily baseline.

However, when we are taking a multitude of signals from the wrist, several autonomic signals, motion, temperature, and we are analyzing patterns with AI on the wrist in real time to alert people to a possibly life-threatening seizure, like the most dangerous seizure, what used to be called the grand mal, but technically it's called a generalized tonic-clonic seizure, convulsive seizure where you lose consciousness and usually people recover from them fine afterwards, they don't need an ambulance, they don't need to go to the hospital, but they do need somebody there making sure that they're in a safe position, they're on their side, there's nothing obstructing their airway, and that they don't progress into a state of apnea, which is the number one cause of death among people who have a seizure disorder.

So that case, we need a lot more accuracy on the wrist because you don't want it just going off every time they move their wrist. And the [inaudible 00:15:44] company Empatica is commercialized and has the only FDA cleared wearable on the market that does seizure monitoring. There's a lot of consumer devices that claim to run apps that do little shake detectors, but they don't pass the bar of accuracy, sensitivity, specificity, safety, cybersecurity, giant list, thousands of pages of tests that a device in this case made by Empatica, has been done to provide that carefulness. So I contrast these use cases. There's ones where you're just trying to learn a correlate of something going on in your body, and then there are other cases where you're going to take an action, you're going to call somebody and you're going to log this for medical purposes. And there, the bar is a lot higher. We do serious amounts of testing and really smart machine learning and signal processing to really get quality data and quality interpretations.

Scott Hanselman: I love that you call that out explicitly, and I want to click on that a little bit because the fact that you take action is so important based on a signal versus simply noting it. And a lot of folks who may not be trained in statistics might look at a data point and go, "Look, my sugar's high, something must be done." But what happened previous, an hour? What does the trend look like? There's so much more to look at. In my open source artificial pancreas, I have an FDA cleared prescribed sensor that has specifically been cleared to take action on so that the insulin pump in the closed loop system doses me automatically based on the signal, which would be different than maybe an Instagram ad for a glucose system for an influencer who just wants a general sense of how food affects their body.

Rosalind Picard: I just want to show this person, if when they run the meeting, they're making our blood sugar spike. We don't need treats brought to this meeting. We need some fiber and veggies and exercise, lower that blood sugar, add treadmills to this meeting room when they're in charge.

Scott Hanselman: So then we have to ask ourselves, when we are interacting with computers and sensors and systems that are going to give us a sense of the affect, and of

course, its effect on us, are we going to then try to close the loop in some way and do something with that feedback? And if so, is it safe to do that?

Rosalind Picard: Right. And it's interesting, when I first started teaching machine learning at MIT, I always started off with the costs of the different kinds of decisions you'd make. The probability of being right for this, the cost of being right, the cost actually being right. There's a cost to being right as well as a cost to being wrong. And over the years, a lot of the machine learning people seem to skip that decision function where you put the costs in, they just put the error in, but there are costs to the different kinds of errors, and you do have to take into account these annoyance costs or these learning costs or these inconvenience costs or the convenience costs, right? Everything, when you convert it to action, there's costs cost.

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Now, right now, we're in a very weird AI moment. It feels like capitalism has gotten its teeth into AI, and ironically, I guess when we talked about products and mouth feel and whether the thing feels right, AI seems to feel good in people's mouths right now when machine learning apparently didn't capture the imagination of the people over the last several decades of machine learning being a thing, I'm sure that you are applying AI to these systems. Has anything changed because of these large language models or at the moment, the hockey stick of AI, or have you already been at the forefront of this for a very long time?

Rosalind Picard: Just the term AI, just what it means has changed dramatically lately. It's funny when you say that the machine learning didn't capture the imagination. I remember having conversations with the founding parents in the field of AI like Don McCarthy and Marvin Minsky saying that the machine learning I was doing was not AI. So the first day when I had proposed a course on machine learning at MIT and was teaching it the first day, I had to contrast and tell my students, "Look, I'm teaching you machine learning. This is not AI. This is pattern recognition. The AI people say that this is too mathematical to be AI. It's not what the brain does. And so you might ask why I'm teaching it because it's not AI?" And I said, "Well, I'm teaching it because I think it works." And so I started showing them how this pattern recognition stuff could be used for a lot of different things we were doing in the lab.

Obviously, I wasn't the only person doing pattern recognition, machine learning in the world, but it wasn't big at MIT. AI was big and not the AI I was teaching. So today, it's very funny to me that when people talk about AI, they're really talking about machine learning. The LLMs, the large language models, foundation models, have made amazing, amazing progress. It's really impressive. At the same time, they're built on a shaky foundation. They're not built on truth, integrity. For the impressive conversations you can have with

them, they're not built on the foundation that entities that usually have these conversations with us are built on. So there are these zingers regularly whereas we're seeing, as people are fond of pointing out in the media, where the statistics drive you into some direction where it just says something that's statistically beautiful and completely wrong and it says it with equal authority because of course, it doesn't know anything.

It doesn't actually know right from wrong or truth from fiction, and some will [inaudible 00:21:38], well, neither do all people. Well, that's true, but we do at least have a sense of right and wrong and so forth. So I bring that up because there are again applications where this is fine. You're brainstorming, you're looking for creative out of the box stuff, and these systems are great for that. We use them for lots of purposes. However, if I'm trying to make a medical decision, again back to something that might be life-threatening, a really serious situation, then I need to trust things in the system that I can't with today's super impressive LLMs. There's that shaky foundation underneath. So I think it calls for some different approaches. It's not enough to just "fix" those models as people are doing. For example, people are making them explainable. How did you get to the decision? But the explanations themselves can be hallucinated. It's turtles all the way down, as we joke. We're going to have to do something different there, I think, for some use cases.

Scott Hanselman: Yeah. I realize that it's not appropriate to anthropomorphize these models and assume that they are humans, but there seems to be this Dunning-Kruger effect of talking to an AI where it's like it's very much overestimating its competence and just like talking to a confidently wrong person at a dinner party, I'm just starting to treat all of these different copilots as random people on the street that I've hired as an assistant, and I just need you to double check your numbers on that and research. And I love that you're excited and I'm excited about your enthusiasm, the LLM, but I really need you to go and back that up with data and stay grounded in real numbers.

Rosalind Picard: Yeah. But they even give the illusion of doing that, like copilot giving you these references, and I was talking to it about something that I know a lot about and asking for its reference, and it was giving me the reference. I go to that page to double check, and the page is not saying what it's saying, it's still giving me the wrong thing with this reference. So I was giving it a better reference with accurate information, and it was still anchoring on the previous one. So that was a little frustrating. I think the referencing is a step in the right, but again, it can give the illusion of being knowledgeable and solid when it's not. So that pretense, that false pretense, that false impression, I think is actually really dangerous for a lot of people using them. And again, there are use cases where this doesn't really matter, it's fine, but there are other use cases where it's outright dangerous.

Scott Hanselman: Yeah. Well, I appreciate you calling it out because in my initial question, I may have implied that ML and AI are like synonyms or they're two sides of the same

coin. And while they may be related, the Venn diagram of the two is perhaps farther apart than the media would have us think. So that's an important thing to point out. So then back to the idea of this feedback loop, if I'm using not AI, but rather machine learning and proper data, you believe that we can create models that will allow computers to really respond intelligently to feedback, whether it be emotional feedback or any signal that we can get out of the person. And it's not AI that's going to make that loop. It's going to be proper data and proper science that is more deterministic, let's call it?

Rosalind Picard: Yeah, I don't know about deterministic, we use probabilities. I've used Bayesian methods from day one. I think we need the probabilities in there for a lot of good reasons, for variability and representing uncertainty and so forth. But I guess ultimately, even those random number generators we build in the machines are, or at least the ones I used to build, were built with linear congruent multipliers. They had underlying deterministic systems in them. So that's a whole other interesting question.

Scott Hanselman: Is determinism possible?

Rosalind Picard: ... What is truly random?

Scott Hanselman: Is determinism possible though in the context of affective computing? Let me give an example. This recording that we're doing right now, it was actually rescheduled. We had a meeting last week, we met. I've never met you before. We're talking on a webcam and the vibes were off, and I said, "Are you in a good headspace? Do you still want to do this right now?" And I don't know what sub-millimeter facial expressions or a sense, again, you're not even in the same room as me, caused me to do that, but it sounds like I was correct and we rescheduled. That's not deterministic though. Maybe I had a 70% probability.

Rosalind Picard: It was astonished when you picked up on that actually, because I'll explain to the listeners as I explained to you. When you asked that, I said, "Well, actually, I just got the news that a friend's 25-year-old daughter died and that really put me in a funk." I have kids around the same age. I was definitely in a weird headspace, a real grieving headspace. I don't think I looked sad, but I was really not in my normal head space and you picked up on something. So kudos to you because usually, people don't pick up on these things that don't know somebody well, and also over video conferencing media, right?

Scott Hanselman: Yeah.

Rosalind Picard: So I don't quite know what you picked up on because we didn't talk very long, but you nailed it.

Scott Hanselman: But then my question then is, should the computer do that? Should the webcam? If I sit down to my Microsoft Teams or my Zoom, should the computer

go, "I don't know if you're in the right headspace to be deleting email today, Scott?"

Rosalind Picard: You're reminding me of back when the Chili Peppers ratings were on the early emails for... Before LLMs, when it was a bit more hardwired pattern recognition of your text. It would detect if maybe this email was a little too hot and maybe it wasn't going to say, "You can't send it," but it was going to flag it with four chili peppers, which would hopefully give you a moment to say, "Oh, did I really want to send a four chili pepper email right now?"

Scott Hanselman: That's what Twitter needs, is, don't send that tweet. It's too spicy. And then you basically have a cool down moment where you don't let them tweet for three minutes and then they have to rethink that they're going to be mean on the internet.

Rosalind Picard: Yeah, there are a lot of experiments going on now with before you share that, have you actually read the article? Do you realize that some people think this is not factual? And I think things like that are really helpful also, if you can turn them on or off, depending on... I think people should still be in charge and have autonomy over these things, although I recognize that private companies running these things are also in charge and have some liability, so there's a balance there.

But I think we need to be very respectful of people when we design all these things and let people know what is happening and give people the say as to what is being done with their data. In our work with affective computing, we have done everything with fully informed consent, IRB approval. I have been opposed from day one to reading information from people without their consent about their emotions. And I know that there are companies out there that do that, very well-known companies, some that have even been mentioned already on this conversation, and not Empatica. Empatica does fully informed consent, but I really think that should be a part of the experience. And if people are not comfortable with their camera, their microphone, sensing affective information from them, then that should not be done.

Scott Hanselman: Yeah, I really love that. As in my space in the diabetes space, the idea that I made the data, it literally came from me, but I have to send the data to a third party healthcare place, and then in order to get it back, I have to sign forms and I made it. This was me that made this.

Rosalind Picard: Right. This is my data. Yeah.

Scott Hanselman: My emotions are my data. And then also, I love this concept of fully informed consent. This is so fundamental to how all of this data, all this telemetry, for lack of a better word, the effect of what I'm feeling, what I'm doing, it's all a telemetry. It's human telemetry. I want complete control of it, and I want to know exactly what I can and can't do with it, and whether or not it's a good idea

to make assumptions or close a loop and take an action, so confidence numbers. Our user interfaces should include all of this context so that one can make the right decision. I appreciate so much that your platforms are doing that.

Rosalind Picard: Yeah. I personally have found it incredibly helpful to get feedback on these data. The systems are still not as good as the best people. You pointing out asking me about the headspace I was in the other day, it was really interesting. You were picking up on something that, it's not clear, I thought I was hiding it. I wasn't. So there's so many times when people are maybe a little late to the party of figuring out what's on their face or what's inside them. For example, we're going to be presenting a paper at the American Psychiatry Association coming up soon where some doctors came to me and said, "We are told that when we sit down with patients who have substance abuse disorders, that often, we appear judgmental, that we don't appear as compassionate as we think we appear. We want to be compassionate. We want to help the patient."

But sometimes at the end of a long tough day, you sit down to listen to them, and maybe your brows a little furrowed because you're concentrating, but you don't really look like you're concentrating. You look like you're angry or you look like you're annoyed, or you look like you're getting a headache and you just don't. The last thing you want to do is hear about their problems. So, they asked us if we could build a tool where they could practice looking as compassionate as they wanted to feel. Now one might argue, is this authentic? Is this a good idea? They're learning a poker face that's not a blank poker face, you're learning a compassionate face. But when you think about it, if your job involves not just feeling compassionate and exchanging information to try to be helpful, but looking compassionate, and these are different things, then maybe the system could be helpful. So we've built that. They're using it. They're excited. It's making some helpful ripples for people who want it, again, with fully informed consent.

Scott Hanselman: Yeah. I was literally told in a executive coaching session on Monday that I have no poker face, and I mentioned this to a friend at work, and they said, "Oh, yeah, everyone knows this about you." You could make animated GIF memes of Hanselman faces, just like, what? And apparently, I've been doing this for years and everyone knows it, and I'm like, does this mean I should turn my camera off on Teams because I'm broadcasting exactly what my face is? But it's so funny, the disconnect between how we think we are perceived and what is the reality. And like you said, it could be millimeters, and it's so fascinating that we could come to a place where our machines could respond intelligently and tell us things that we would ourselves never perceive. I think that's really cool.

Rosalind Picard: Yeah. Yeah. It's funny you have that too. It was once called Leaky by a great emotion theorist because of showing everything on my face. But actually, I chose to let it be shown, actually inspired by an artist and just a brilliant philosopher artist, Bill Watterson, who did the Calvin Hobbs cartoons for so many years, which I miss. I love, love, love his work. And his characters were so

expressive, so wondrously, enjoyably, expressive that I thought, why not? Why not show a little bit more expression in daily life? And actually, others now have done work in learning experiences, Cynthia Brazil's group at MIT and others with robots, that when the robots were more expressive, when engaging with people and learning interactions, that people learned more. They not only enjoyed it more and were more engaged, they learned more.

Scott Hanselman: Yeah. Well, this has just been an absolute joy. Thank you so much, Dr. Picard, for hanging out with us today and for sharing your knowledge and for getting folks excited about this.

Rosalind Picard: My pleasure. Thank you for giving us this time together.

Scott Hanselman: This has been another episode of Hanselminutes in association with the ACM ByteCast. We hope you've enjoyed this episode. If you have, I encourage you to take a look at the back catalog and explore some of the other episodes of both Hanselminutes and the ACM ByteCast podcast. We'll see you again next week.

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