

Interviewer:

This is *ACM Bytecast*, a podcast series from the association for computing machinery, the world's largest educational 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.

Interviewer:

The world of software development is built on the foundation of open collaboration, peer learning, and communication, but in a world where half of those voices may be muted, how do we expect to reach great heights of innovation that the field of computer science promises? Our next guest is a human computer interaction researcher, who works on uncovering the barriers to inclusion and participation in the world of software engineering. Denae Ford is a Senior Researcher at the Software Analysis and Intelligence Team at Microsoft Research. Denae, welcome to *ACM Bytecast*.

Denae Ford :

Thank you for having me. Thank you for this amazing introduction. That was very well said.

Interviewer:

I appreciate it. Thank you. And it's all you, and you have so much depth to your work, that it was very easy for us to cobble together something that would represent the amazing work that you do. But I'd love to lead with a simple question that I ask all my guests, Denae, if you could please introduce yourself and talk about what you currently do, as well as give us some insight into what drew you into this field of work.

Denae Ford :

For sure. I'll introduce myself again. I am Denae Ford Robinson. I publish under the name Denae Ford. That's why you will also see my publications under my pen name. I came from a computer science background, a software engineering background, my bachelors, masters and PhD are all in computer science. I also have a graduate minor in cognitive science, which was really important for me to obtain or to give a little deeper understanding of how people engage with communities and then tensions behind that. Understand a little bit of cognitive theories that are at stake or are in progress here in these spaces. I think you asked what got me into this work. As an undergraduate I was also an undergraduate researcher in my university, and I was able to work on this really cool project called Java Tutor, which is an artificially intelligent tutoring system with Dr. Kristy Boyer and Dr. Joseph Grafsgaard.

Denae Ford :

And it was really exciting to see how important and relevant it was to how people ask questions [inaudible 00:02:33] automated tutor. We were seeing how students ask questions and how we were able to perceive the best questions they asked. How they perceive the responses they received. And it was really exciting to me to figure out that this is what science can be. You can study these questions that impact humans directly and how they use computing systems.

Denae Ford :

That was really an amazing experience for me, which thrust me into my PhD research, which was understanding how people engage in online programming communities and not just engage, but meaningfully engage and find value and then feel welcomed and find belonging in. A lot of my research focuses on, or my dissertation research focused a lot on Stack Overflow, which is one of the online programming communities that I've mostly focused on and then GitHub, as I transitioned towards the end of my PhD. Understanding how developers engage in online communities from Q&A to open source was really all a part of the entire developer experience. I wanted to get insight into all of that.

Interviewer:

Yeah, that's incredible. I think collaboration places like Stack Overflow and GitHub, of course, has become so integral to a software developer's life to be able to share knowledge. One of the things that I was reading about your work was around socio-technical ecosystems. I was wondering if you could help unpack that a little bit for us. What does that even mean?

Denae Ford :

Yeah. The term socio-technical ecosystems originates from this description of [inaudible 00:04:01] description of how people engage socially and technically through communication, which is essential for professional work. This term has basically been adapted to ecosystem as sustainability of the community relies on reinforcement of consistent social and technical dialogue for group members. What makes these communities, what I focus on, online programming community, which is a type of socio-technical ecosystem, is that many of the members and their actions and how they affect each other to help them develop niches. There's a couple of types of or fundamental problems of socio-technical ecosystems that people work on, but a lot of my dissertation worked on architecture and governance. And when I say architecture, I mean as in mechanisms of engagement and governance as it (will) help people felt comfortable to do and how we can develop new mechanisms to encourage people to engage in meaningful interactions in online programming communities.

Interviewer:

Got it. What really makes you interested in this, Denae? Why is this important to a software engineer? Why is that engagement important?

Denae Ford :

For me, I really got interested in this whole area, I mentioned my undergraduate research experience, but as an undergraduate in my computer science courses, I found that being vulnerable to ask for help or figuring out the right ways to ask for help and where are you feel comfortable seeking that information was so important, even how you... Goes down to how you ask a question, because that can dictate the answer that you receive. It was really interesting to me about how so many of the computer science students use and relied on Stack Overflow to read, but not much to contribute. Actually I really took that interest into my PhD program where I told my advisor, [inaudible 00:05:49], I want to figure out... I did actually say, I do want to figure out how people engage in online communities. It was kind of broad and I was like, "People who look like me who engage." He was like, "Well, that's too broad too."

Denae Ford :

We narrowed it in what are the challenges people, specifically women is what we started with, engage on Stack Overflow. Then we identified a set of barriers and that actually dictated the rest of my research moving forward, which is identifying the challenges people have in engaging in online programming communities. Step two, understanding what mechanisms they're using to overcome them. And maybe they're not official mechanisms, but maybe these are things they're doing ad hocly, to make these ecosystems work best for them. And then step three, losing all those learnings from those prior two steps to understand how we can build interventions on platform that can keep people engaged and make them feel welcomed and more comfortable asking questions and asking for help.

Interviewer:

That is such a valid point. I think I'm guilty of it myself, being more of a reader than a contributor. Sometimes, you feel like you're not qualified enough. Sometimes, it's a little bit of intimidation because there's people there who seem to be more knowledgeable than you. And you're afraid of maybe saying the wrong thing, but there is tremendous value in being able to participate and being able to give back as well. I know that from other interactions in my life that the ability to give back, builds confidence in your own talent and your skills, let's break down the three parts that you spoke about. The first part was really, what are the biggest barriers? I don't know if you could give us some examples of what were the biggest barriers for people participating in these communities? It sounds like there are specific groups of people that have a particular challenge in participation.

Denae Ford :

I'll start off with step one. The reason we actually went in, identifying the barriers of women who engage in these communities, is because when we dive in deeper into the annual reports of Stack Overflow publishers externally, this was the group that had the least amount of representation. For context, a lot of software development of full-time roles report about 20% to 28% women in their fields, on Stack Overflow, consistently it was below 8%, 7.8. I think before I started doing the reports, a lot of empirical software engineering researchers were finding 5%. Think about this, on the internet you can be anyone you want to be, but you still didn't feel comfortable asking for help. There's a social barriers and cognitive barriers that are at bay here. Because we wanted to figure out this is the population that is not engaging, let's start there.

Denae Ford :

The goal for my research is really target the few, help the many. In all the steps of my research directions, I mentioned hints at this. Where although we started with identifying the barriers that women experienced in these communities, we ended up identifying that these are barriers that exist for people across the gender spectrum. And we're able to use these barriers in order to build systems that can benefit the entire community such as the Stack Overflow mentorship program, which was informed by the barriers that we found from the first round of studies. That was really exciting. Did you ask a question about which barriers were like really interesting?

Interviewer:

Yeah. The fact that you brought up a few barriers, but yes, which were the ones that sort of really stood out to you?

Denae Ford :

We actually did identify about five significant barriers as in stat sig across men and women. But the point was not just to say that these barriers are divergent, they exist across the spectrum. They're not dimorphism, everyone faces these challenges. And some of them are this fear of negative feedback, for example, which is what one participant mentioned, I fear my posts may be harshly criticized. I'm discouraged from posting. Another one is this idea that is the intimidating community size is quite discouraging. The way I described this barrier was, the statement from participant [inaudible 00:09:52], I feel intimidated by the large community of users. I instead prefer connecting with a smaller and more intimate group. You were seeing that this idea of sub communities or having a safe space, if you will, was very valuable for participants and just [inaudible 00:10:08] to have.

Denae Ford :

And of course we've seen ones that actually resonate quite well with those across the gender spectrum, which is this qualification barrier where participants mentioned, I feel my expertise or answers will not be enough to help anyone else. That sounds a lot like imposter syndrome. Manifested in a different way. What was, again, really interesting here is that although we were able to identify some of these barriers, they significantly hinder women more. We saw that the use, understanding how these barriers can... Or how we can flip the bit on each of these barriers to turn them into interventions. For example, if someone mentioned the intimidating community size is discouraging for me, like I mentioned, how do we make the community size, feel less intimidating? Let's mix up communities, for example. That's just one of the benefits of the Stack Overflow mentorship study, which is we essentially created this sub community where people can draft their questions. Then they're not published to the entire community just yet, but you have a sub community. You can get feedback on your question and be able to have it more meaningful and fruitful engagement on the answers that you receive later on.

Interviewer:

That's incredible, because that's the richest way to enhance a product. I'm thinking about this from Stack Overflow's point of view. Getting that feedback from your user community on what would be most valuable to them, really drives improvement in the product in the most significant way possible. How did you go about experimenting with this? Did you try it out and measure it in some ways to see if there was any improvement in the participation numbers or metrics that you were measuring?

Denae Ford :

Yeah. I'll talk a little bit about that. From the barriers work, there was another one of understanding mechanisms people are already using or understanding mechanisms women are using. But the actual third part, which is the intervention and learning from these mechanisms, is collaborating with Stack Overflow using this mixed methods approach, where we took a qualitative and quantitative approach to understanding how people engaged. We created this pilot study where first in order to figure out what we needed to work effectively on the larger scale platform, we used Slack at first, actually, to do the smaller experiment, to see how mentors and mentees will engage. And ultimately what we found is that the timing was very important. The iterativeness of being able to get iterative feedback on what you're asking for help with. We learned that we wanted to create a supplemental experience to what people were already having on Stack Overflow.

Denae Ford :

We didn't want to build a new Q and A, we wanted to build on what already existed. Teaching people to ask better questions, not answering questions for them. It was a large learning

experience there. And from that we implemented this collaborative editing feature, which essentially took advantage of the chat feature that exists on Stack Overflow. You have chat rooms on Stack Overflow for a host of topics, languages, and people can spin them up for other different types of projects that they're working on. We used an instance of that or four instances of that and created private spaces where you can actually post your question there, edit it. And then from there, after you get feedback from a mentor, you can choose to launch your question whenever you feel is appropriate. It really helped novices engage. We had over 70 000 eligible novices, it was a 33 day study with four help rooms and one private mentor room. But we had 70 000 eligible novices available to receive the intervention or did receive the intervention. 520 actually accepted it and entered the help room, 271 novices engaged in conversations, 343 conversations with our 63 mentors.

Denae Ford :

From there, we had a lot of data to analyze. We had transcripts from the dialogue between novices and mentors, question scores, as in what was the scores of the novice questions after they received help. We also survey novices and interviewed mentors about the experience because since this was a live feature on Stack Overflow, we wanted to make sure that there was some benefit to the mentors who were engaging here, who volunteered their time. And the novices who were trying to [inaudible 00:14:29] their new niche, get their footing if you will, in the community.

Interviewer:

As I'm listening to you, it just sounds like such an empowering experience to be able to help these people feel comfortable asking questions. Being able to get that help in a smaller setting so that I feel more comfortable with what I'm putting out there and more confident. I think you preempted my next question, which is really why do the mentors engage? What is it that they get out of this experience? Is it just goodness of my heart? I want to help the community or is there more to it?

Denae Ford :

Actually, the way it started is, we posted on the Stack Overflow meta page that we were running this experiment, or we wanted to do this. We had an idea of this coaching experiment. What should it look like? And on the Stack Overflow meta page, you can actually get feedback from the community members about new interventions, how they feel about new features or old features that already exist. It was pretty helpful to get feedback there. And then in a separate post, we asked those who were interested in contributing or being a part of the program to volunteer. We had a screening process where we checked that they had teaching experience, what was their motivation for engaging and to make sure we didn't have just trolls sign up, which

is where collaboration with Stack Overflow was very helpful here, because they have their own lists or black lists of people who may not have the best of intentions.

Denae Ford :

It [inaudible 00:15:53] people out before we allow them to enter this experiment. But mentors really reported that it was really exciting to be able to help novices do their first interaction and very fruitful for them because it got them thinking about, again, what it was like to be their first time posting on Stack Overflow. And reflecting on that experience and maybe even moving forward, how would they impact how they moderate questions? No data on that part yet. But there was a lot of discussion about what could be, and I think that was one of the goals, to get that conversation going and get them thinking about what the new Stack Overflow, what community we want to have here. What do we want it to look like? And how welcoming should it be?

Interviewer:

That's incredible because the mentors that you probably picked are who we may call, quote unquote, influencers. They probably set the tone of the conversations in many of these forums. Having them be aware of these challenges and start thinking along those lines in itself is such a significant way to move the needle in the right direction.

Denae Ford :

Oh, for sure. For novices, think about it from their perspective, for them previously being lurkers, just observing how people engage in the community. There's also a barrier about this conflict fatigue of watching other people get their questions voted down. Now they're able to see the other people actually support each other because the way they set up the mentor help rooms, was that a mentor was helping a novice or multiple mentors helping multiple novices in the same room. They now have this legitimate peripheral participation, or just example of what's appropriate and what's effective. And hey, I'm not the only one seeking help here, it's other people struggling, it's other people receiving help. And they don't feel as isolated anymore from the novice perspective.

Interviewer:

Got it. Is this a formal program now, Denae? I mean, power post the experiment, what was the sort of the life of these changes?

Denae Ford :

Post experiment, we did actually end up writing a paper about the work and actually we went back to the same Stack Overflow meta community to share the findings of the work. This work

was with Christina Lustig, who at the time was the first researcher at Stack Overflow. We had Jeremy Banks, who's our developer and Chris [inaudible 00:18:02], who was my advisor and we were working on this. Following the experiment we wrote the paper as well. And Christina ended up doing a couple of podcasts internally. At the time the vice-president of community and growth had highlighted the work in their annual summer of love posts about how to make Stack Overflow more inclusive and welcoming. That was so amazing for it to be shared that way. There were also some follow-up studies that were going about new question templates and what that will look like. I actually haven't been able to connect with them so much so far because everyone reorged and moved teams and moved around. But I'm looking forward to staying connected with the research and we still have data we have yet to analyze and report. There's more to come, TBD for sure.

Interviewer:

Wonderful. We can't wait to hear more. I think this in itself is such a revelation and really opens my mind and I'm sure all of our listeners as well in our own interactions, thinking about what are the communities that we engage and do we hold back? Or are there others that are holding back that we can help open up and participate more? One of the other pieces of information that I gathered as I was reading about your work, was this concept of peer parity and how it helps foster engagement. I was wondering if you could help us understand that a little bit more.

Denae Ford :

Yeah. The peer parity work is really centered around what I mentioned of the part two of my three part process where one is identify challenges. Two is what are people already doing? Peer parity is when an individual can identify with at least one other person or one other peer in the community they're engaging in. Essentially, this is really taking Nicholas [inaudible 00:19:42] idea of social facilitation and how you can empower and encourage people to engage in the activity by doing it yourself. By being visible and doing it alongside them. In this study, we were really measuring, trying to see how women were encouraging and engaging with other women in this community. To figure out if they actually came back for more. One of the cool things about this study was that we did see women engaging with other women as in answering questions from other women so much so that in our peer parity and our non peer parity distributions, the cumulative density of the length, the time between re-engagement was about 330 days.

Denae Ford :

Although this was a small sample, because there's already a few, I mentioned the less than 5% and less than 7.8% of women in these communities. But the fact that we were able to see that there is some phenomenon of affinity groups, that you can only see at software development companies or your women in computer science groups, and how think about the mentorship

guidance that happens there. If there's a way to see, identify, how the people do that online, maybe there's opportunities for us to figure out how to make that a concrete intervention and a part of these ecosystems. We saw there was value in saying it there, but I'm curious to seeing how that influenced how we do other programs like mentorship in person and also online and keep it sustainable.

Interviewer:

It's very interesting that you bring that up because in a smaller setting, I think we were talking about code reviews and new people entering a team. One of the engineers that I was speaking with, spoke about the fact that in order for them to break the ice with somebody new who's come in and who's not participating enough, they usually offer to do peer programming with them. They feel like they share their code with that other person so that they're actually making themselves feel vulnerable so that the other person realizes that, you know what, it's not always perfect when it comes out the first time it goes through multiple reviews by my peers. I'm okay taking that feedback. And so it's okay to share your work because it only helps improve it. I know you've studied some work around inclusivity in code reviews and peer programming. I was wondering if you could talk a little bit about that.

Denae Ford :

Yeah. I Would definitely say that the phenomenon you just explained is exactly what the social facilitation is. You said it and I thought about while my work is definitely all about vulnerability, that's actually a great word to describe all of the research that I'm doing. How do you get developers to feel more comfortable being vulnerable while they're doing their technical task. I think that's really interesting. But the paper or the work that you're mentioning is the study I did to understand how people reviewed pull requests from people who are on their teams. In this study we use [inaudible 00:22:34] methodology. I used the [inaudible 00:22:37] hypotheses that people are tending to what they're looking at, as in not to say that it's the most important thing, but it is of interests in some regard to them.

Denae Ford :

They're looking at it and they're consuming it. The methodology for this study was that to be presented a profile page of an identifiable man, identifiable women, or an unidentifiable person where it's just a default avatar image, we presented their profile page and the single commit of their pull request and ask the participant to decide to either accept, which is to merge or declined to merge, just pull requests on a scale. But we definitely had a couple of people who was just undecided as well, which is not [inaudible 00:23:22] to merge. But it was really interesting to see in the study, how people were reviewed three different types of signals, which are prevalent in three different types of ways. The three signals we looked at were code signals, which the

primary ideally, should be the primary co-contribution. This will be your, when you look at the diff between your code snippets, it's the before code snippet and after code snippet. Ideally, if all is a meritocracy and that's the only thing that mattered, people should only be focusing on the content of the code snippet. And that's an ideal world.

Denae Ford :

The second attribute, which is interesting is the technical signals, which is your peripheral technical signals or peripheral to the code, which tell you a little bit about the person's contribution history, the projects they contributed to, maybe the title of the pull request and the issue that they're working on. And then we had social signals, which told you a little bit more about the person's identity. The social signals that included for this study, identified the areas of interest being the avatar, their name, the avatar image, and name on their pull request page, which for those of you who may not have a pull request page in front of you right now, it is very small compared to the other technical attributes on the page of a single commit of a pull request. Very similar attributes there. Versus on the profile page where there's a ton of other technical peripheral information, like your contribution, heat map, projects, et cetera.

Denae Ford :

The interesting thing that we saw here is that all but one participant said, he looked at the avatar image, all of them consumed this image. All of them consumed social signals, all but only one reported that is valuable in some way. The point of the study was not to call developers are liars and they're not trustworthy. That's not the goal of this. The goal of this was to understand what signals are we innately even using that we're not conscious of and how do they heavily influence what decisions we make and how we review each other's technical contributions. Again, majority of people, many people did focus on the code, but the fact that there were times where there was quite a distinct amount of time, significant amount of time spent on social signals, which are significantly smaller and sometimes three times as small as some of the code signals, and technical signals. Was quite interesting and important to highlight.

Interviewer:

I think that's absolutely fascinating work. I wonder Denae, would you have guidance for people like us in industry? We may not know of the bias, but clearly there is some unconscious bias that's happening there. What would be the interventions that we should be even looking at? Are there small steps that we can start to take to make this a more fair and equitable process?

Denae Ford :

I think for step one, we could be very transparent about what we care about when we were doing pull requests. That's [inaudible 00:26:12] things in the study I asked about were, what is

important to you and how do you perceive others? I think reflecting on how you review others' work in the standard you hold yourselves up to was a nice reflection exercise to figure out, okay, am I being unrealistic when I'm reviewing others' pull requests about content I'm expecting? Because we did see also quite a mismatch there as well about what type of attributes and signals you were looking for in others' technical profiles and social profiles as well. Having guidelines and perhaps even a checklist of some sorts, I know that's a popular intervention for a lot of the mechanisms developers are recommending right now. Having a checklist to be able to say, before you wrote, or before you merge or decline to merge or leave it stale with pull requests, have you checked these things?

Denae Ford :

Have you already checked the code? Was that the first place you checked? How applicable is this code going to fit into your code base? Do you predict any conflicts coming up or does this code have test cases that are reasonable and bespoke to the issue that you're working on? I think if we have a checklist about focusing on those types of information or those attributes would be very valuable. But also let's be honest, if we are going to look at their previous history, we are going to look at the contributions they've had. Let's be transparent about how we use those things. And let's not act like it's only a meritocracy. I think the issues come into play when when we pretend to ourselves that we're not using social and peripheral signals about individual. Once we do become more transparent about that, I think we'll see how a lot more interesting discussions about what's important when we're reviewing pull requests.

Interviewer:

That's a super key point that you bring up. Do you think that there is any room at all for automation here? If we reduced the amount of human validation, may not be a low hanging fruit, but is that the way we should be headed where we try and automate most of these things so that we actually reduce the bias?

Denae Ford :

I think the issue with automation, especially at times like this is that when people results [inaudible 00:28:27] automation, they're not thinking about the ethical edge cases, the context that influences automation and who's building automation. Hence, a lot of bias algorithms figuring out what's important and what's valuable. I think that we have a long way to go before we see some valuable automation done or one that's well-rounded, especially when we're talking about the prior history of each individual's work. When we start checking the contribution activity in the contribution heat map, popular projects people take pride in and pin to their repositories on their page. I think we should be taking into consideration that context. Until automation takes into that context, I think we have a long way to go.

Interviewer:

Got it. Yeah, no, I think that's an incredibly valid point. One of the things that I was also thinking about is, as I'm thinking about a pull requests and code reviews, a lot of the people that are doing these activities are colleagues of ours. They're friends of ours. And we'd like to believe that they want to be fair. In many ways, they probably don't see the gaps or the challenges that some of their peers might be facing. I'd like to switch a little bit to how you became more aware of the fact that the path isn't as smooth for everybody as it is for you. But I know you went to a science and technology focused high school. And I'm sure a lot of the people that were in your peer group there were similar to you, focused on STEM, probably had the aptitude for math, science, and technology. Not just aptitude. I mean also the opportunities. What point did you realize that the world was not fair to everyone?

Denae Ford :

What point did I realize the world wasn't fair to everyone. I found that out a long time ago and we can talk about those experiences, but I don't think that's what you're asking. I did go to a science and technology public high school in Maryland. My high school was predominantly Black. My AP computer science class, which is a part of my science technology program was fairly split, half, half men women. My instructor of my AP computer science courses was a Black woman. My instructors were my other HTML and CSS courses were Black people. I'd never realized that there was a distinction quite so until I got to college and I took my first computer science class and I got an easy A plus and a lot of my colleagues were struggling. And I realized that two things, that one, I was one of the only Black people, women period in that course.

Denae Ford :

But two, I had opportunities to thrive. I had opportunity to go to a technology high school where I was able to learn a lot of these skills and learn about object oriented programming through Java and a whole bunch of other programming languages very early, which prepared me and launched me into my successful undergraduate career. Because had I not had those experiences earlier... A lot of people after they took that first [inaudible 00:31:32] science class, they think it's not for them. And they flunk out if they don't do well. I fortunately had like the support system and the resources and kind of the prior knowledge to be able to work through that. For me, I found out that I was going to be quite the unicorn early on once I got into my courses, but I knew that I didn't want to be the only one.

Denae Ford :

Going back to when you asked me about the reasons I'm doing this research or how I got into it, that conversation with my advisor, I remember one of the first times I met him and [inaudible 00:32:03] I want to figure out how to be, not the only one anymore and being his very expertise as a advisor, being able to discern what part of that can we put into research and guided me to me and my first couple of research studies understanding the barriers of women in computing. I think being able to have such a strong community that has been able to pour into me and to support my research, although they may not always understand it or where it's going, has been really helpful. And I really hope that I'm able to recreate or keep that going, keep it be light to someone else and eventually be able to encourage others to do very meaningful, impactful research like this.

Interviewer:

Oh, absolutely. I strongly believe you can't be what you don't see. And it's so important for all of us to have role models like you to aspire to. This has been an incredible conversation, Denae. For our final bite, I'd love to understand and find out what are you most excited about in the field of HCI or in your research coming up over the next few years?

Denae Ford :

Really being an intersection of software engineering and HCI, I feel like I have a nice little... I get excited about so many different types of research. That's the beauty of being a kid in the candy store. But if I were to say, what do I see the field of HCI intersecting with software engineering over the next five years? There's two things that excite me. One is the next generation of software developers who now enters the technical field once they're able to see how impactful the work that they're doing can be. Who's not wanting to enter, be a software engineer because they were able to contribute to open source project, to help trans people find restrooms or find safe restrooms, or who's [inaudible 00:33:48] to be able to enter the field of software engineering because they watched videos on YouTube and saw someone who was also a truck driver transitioning to a software developer. And they were like, oh, that's my life. And they now can now feel empowered and excited to be a software developer.

Denae Ford :

I'm excited about what the new shape of software development looks like beyond the traditional classroom in the university context. And second, I'm also looking forward to seeing what that in turn also impacts the tools that they build. The new tools that we haven't even thought of yet that can influence what we use every day. Thinking about how you use different types of social media every day, you use LinkedIn quite a bit to connect with professionals. There's a tool that's going to come out eventually years from now, and it's going to come from someone who's not coming from a traditional background. They're going to bring the expertise from a non-computer

science background into how we build systems and it's going to blow us away and it's going to be something we rely on heavily. I'm excited for that moment. I think those are both directions that I see a lot of our tech people going in, the non-traditional routes and supporting those who have the non-traditional experiences that will be valuable for everyone.

Interviewer:

Oh, your passion is so palpable, Denae. I'm giddy with excitement at the prospect [inaudible 00:35:01] Thank you so much for taking the time to speak with us at *ACM Bytecast*.

Denae Ford :

Thank you so much for having me. This was really fun, actually.

Interviewer:

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