



Women in Software and Cybersecurity: Dr. Carol Woody

Featuring Carol Woody as Interviewed by Suzanne Miller

Suzanne Miller: Welcome to the SEI Podcast Series, a production of the Carnegie Mellon University Software Engineering Institute. The SEI is a federally funded research and development center operated by Carnegie Mellon University. Today's podcast is available on the SEI website at sei.cmu.edu/podcasts.

My name is [Suzanne Miller](#). I am a principal researcher here in the Agile in Government section of the SEI. Today, I am very happy to introduce my friend and colleague, [Dr. Carol Woody](#). She is the head of the Cybersecurity Engineering Team in our [CERT Division](#). CERT is focused on cybersecurity. You are involved in cybersecurity engineering. We are going to talk about what that is about, but we also want to talk today, as part of our [Women in Software and Cybersecurity series](#), what brought you here and keeps you here in this very challenging technology area. Welcome Carol, and thank you for joining us today.

Carol Woody: I have been looking forward to it.

Suzanne: Let's start actually by talking about what is exciting about your job. What is it that challenges you and makes you want to do cybersecurity engineering? Some people are probably going to say, *And exactly what is cybersecurity engineering?* Why don't we start with that.

Carol: I actually grew up in the software-and-systems development world and got into cybersecurity because they were trying to figure out, *How do we build systems and software so it can be more secure?* So much of what I am doing is really exploring how do I identify the ways that will help us better make software securable, I would say.

Suzanne: *Securability* is our new quality attribute.

Carol: Well, it is more than a quality attribute. It is how you are using the software because it is tied to more than just intrinsic parts of the software. It is how it is implemented. What it is linked to, your trust relationships and also how well it is built, because quality has a lot to do with software.



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Suzanne: So it is software plus the ecosystem that it lives in.

Carol: Exactly.

Suzanne: That creates a whole different set of challenges that are not just about engineering. It is about operations. It is about human behavior.

Carol: It ties to the full lifecycle.

Suzanne: Organizational policies, supplier. I know you have done work in supplier risk management.

Carol: Yes, supply chain.

Suzanne: Supply chain management, yes.

Carol: Who you buy from, and what you are using it for, and was that what it was originally designed to do, or are you stretching it to do things that it really can't or can't do it securely?

Suzanne: So, your whole focus is on the securability of the systems that you are working with and understanding the full ecosystem.

Carol: Well, there is another part to it, and that is trying to translate what we as experts learn into the knowledge that we have to transfer to the current workforce and the incoming workforce, because you will never have enough cybersecurity experts. So, how do we bring everybody else up to do enough, so that we can end up with a good result?

Suzanne: Part of this is about enticing younger people—men, women—into these fields. Because, as you say, we are never going to have enough cybersecurity experts. We are never going to have enough people that build good software. We just keep adding more and more things that we want software to do. Let's switch to talking about what made you think that this was a good field to be in. When did you think this was a good field to be in? What brought you to this? One of the things that we ask people is, *Were you a geeky nerd that did math equations in your spare time as a fifth grader?* I know somebody who did that.

Carol: Yes. I was a math major.

Suzanne: See, there you go, we got you. Some people do and some people don't, but talk a little bit about what that was like growing up and where it led you.

Carol: Well, I wasn't so much focused on excitement about doing math, it was just I liked doing puzzles and problem solving and understanding what was going on. I wanted to know how it went behind the scenes.



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Suzanne: Did you take things apart?

Carol: No, but I was always looking for patterns: *How can you improve this? How can you make that better? What structures fit together?* And, *If I do it this way, will it work better than if I did it another way?* I was looking for different ways to make things happen. I did a lot of crafting work, a lot of sewing, a lot of handwork type-of thing. Tools are another thing you play with. My first run-in with discrimination, though, was that I wanted to take shop in junior high school. When I was in school, girls didn't do that.

Suzanne: No, we did home economics.

Carol: I already knew how to sew, so I had to go learn how to sew again.

Suzanne: I was in that. Yes, I remember that. Did you ever get to take shop?

Carol: No, and I have cursed that principal every time I have tried to hammer a nail. It's like, *I needed this information for life.*

Suzanne: You and I are kind of that generation where we had much more defined gender roles.

Carol: Structured roles, yes, very much so.

Suzanne: ...in terms of our education. When did you really start breaking away from that and being who you wanted to be not just what the societal norms were?

Carol: Well, when I started college, basically women were funneled into, let's see, it was a teacher, a secretary...

Suzanne: Don't forget nurse.

Carol: Or a housekeeper. My mother was a teacher, so I was aiming for teaching, and math was my field, so that was what I was going to teach. I spent two summers working as camp counselor, because there really weren't that many summer jobs for girls, short of babysitting, and I wasn't good at that. Then I found out camp counseling was babysitting, just on steroids because you got 10 or 15 kids for a week. Then I thought about, *Well, what is teaching going to be? It's going to be 30 kids, hour after hour,* and I was not psychologically prepared to deal with that.

But I was fortunate because they were just starting computer programming under the math department in my university. I was a very motivated student. I wouldn't say I had good professors, but I was motivated because I had school debts to pay, and I was going to learn a skill. Fortunately, this was one that paid well, too. So, it worked out in terms of getting started with software, and that is where I got on working for the government. Then eventually I moved



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into banking and manufacturing and switched over to mining. I have worked for government, universities, doing administrative work, installing major systems and supporting them.

My last job on the software side was as a strategic planner in New York City. They stood up the administration for children services and pulled all the technology from all over the city, put it all in one building and said, *Work together*. So, I was one of seven planners that was basically sitting there trying to figure out, *OK, How does finance talk to the legal group, and then they talk to the case study people?* because none of the technology was built to work together. Like I said, I like problem solving. I like puzzles.

Suzanne: What brought you from that very strategic leadership kind of focus in the industrial world to the SEI, which is much more research?

Carol: The CERT group basically offered me a role in terms of starting to define how we would make software more secure. Initially I said no, because it didn't fit my career plans. But over time they talked me into it, and my husband said, *Are you sure?* But I made the leap, and it has been interesting ever since. I was expecting a 90-degree learning curve, and it was more like straight up, [Mach 9](#) because the fields are so drastically different. But what we were tackling was the challenge of, *How do you figure out what you need for security and then explain it to the engineers so they can build it?* It's that language translation, and what's working and what's not working. We are still trying to figure it out.

Suzanne: You have worked with lots of men, lots of women in your career. One of the things that we know from research in HR [human resources] is that it is harder to get women into technical fields, especially the software field, and it is also harder to keep them. What are the things that you have run into and some of the strategies that you have seen, that you have used and you have seen other women use to be able to stay in this and really do what you love?

Carol: I'm not sure about strategies so much. I certainly have been impacted by decisions of women to leave. I've had many on my team that are basically making strategic family choices because their sense is that somebody in their family has to take a stronger role in either the childcare or parental care or something along those lines, and economically in their situation, their husband is the stronger breadwinner, because traditionally men are paid more. So, they have been making straightforward economic choices. In my case, my husband was self-employed, so my job in staying in the workforce was important for us in terms of benefits and the steady paycheck. I had different drivers in terms of what was motivating me to stay in the workforce.

One of the challenges I have seen of bringing women into the workforce, especially in the cybersecurity side, is that they are very intimidated to be the only woman on a team of five or



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seven men. There are limited chances for them to work closely with other women in the cybersecurity side. I think that is reducing over time, but it is still a long haul in terms of bringing in a basic, large body of women.

One thing I found interesting in the state and local governments and city where I worked is they were predominantly women. It was the flipside that I ended my system-and-software career working in teams that were 90 to 95 percent women. Equally as odd in terms of the combination and moving ahead and bringing people in, and the pay scales tended to be a lot lower in those environments because they were traditionally paying women less. As a consultant I wasn't impacted by that because that was the role that I was playing, but I think economics is a key factor. Organizations that hire women and pay them less can expect to lose them.

Suzanne: Yes. That is an expectation that if you don't have it, you are going to be disappointed.

Carol: Yes, exactly.

Suzanne: In terms of giving advice to young women, as well as young men that are thinking about this kind of career, what would you say? How should they prepare themselves if they think they might want to work in cybersecurity? What kinds of things should they pay attention to in their education, especially if they are younger in say, high school, even college, but what are the kinds of things you would say, *Pay attention to this. Don't let go of thinking about these things.*

Carol: You need to have some understanding of technology and how it works, but at least for the role that I have played throughout most of my career, I am looking at how to apply technology. I am more looking at, *How can I make something that was built for a certain purpose have a broader value, improve it, or apply it in a different area or make certain changes that will then make it more useful?* In that case, I need a broader understanding of how people would use the technology. *What would they be doing with it? What is working now? What are they still doing that they think that there are other ways that they can potentially improve how that is done?*

Suzanne: What are the bottlenecks that are keeping from meeting their goals?

Carol: There are bottlenecks but also looking at the organization and saying, *How can things function better?* When I was first starting out before we had all the fancy gizmos of handheld and a lot of the things that make us more mobile...

Suzanne: Punch cards!

Carol: We were dealing with a lot of more physical office restrictions. But still in that case, software was a major part of what we were doing, and the queue of work that needed to be done on the software was just ever expanding because there were never enough people. So, I was using my skills in terms of patterning and understanding priorities to figure out, *What should we*



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tackle first, and how should we organize the work? Analyzing what is breaking at night because we were on 24-hour call. If something is continually breaking, why? How can we figure out and what do we need to do to make it better? My goal was reducing the backlog and making the software more effective.

Suzanne: What would you say to people that, unlike you, really didn't get along with math in school? Because that is one of the disciplines where patterns is how you live through it and solve the puzzles. But if that is not a strength that someone has intellectually, what are some of the other things that would help them to be able to work in this area?

Carol: Well, I bring one view to it, but it takes a team to make a system work effectively and support it. I would say I am less creative than some other people are. Having ideas of different ways to do things and looking at it differently. Looking at something as, *Gee, I could do this if I had x*. That involves a very different mindset of really understanding how you are performing a business function and then having ideas about how to make it better or how technology can do something that you are tired of doing—*How can I pawn this off to somebody else to do it?*

Suzanne: The thing that struck me about one of the other people I interviewed, the statement they made was, *If you are curious, that is a big part of wanting to dig in to figure out how things work.*

Carol: But on the cybersecurity side, you are looking at something a little bit different. You are looking at it from the standpoint of, *How could somebody break this? Or, How could somebody use it against what you're trying to accomplish? And then, How do you figure out ways in which you can improve the way you are applying it, so that it is less likely to occur?* So it takes a real understanding of how is technology actually used and the realistic ways in terms of how something can be broken. In some cases, that is just widely reading. That is really understanding what is happening out there. A lot of exposure to current problems and current challenges and then playing *what if* games with it.

Suzanne: *What are the edge cases?* is what we talk about a lot of times. Speaking of reading, this is a field that is daunting to many people because there is so much going on, and there is so much information. I have got a reading list that I will have lived to be 100, and I won't have read everything that is on my reading list. But how do you prioritize? How do you deal with all that information overload and get through at least a minimum set of things that you think help you to stay current in this field?

Carol: I pick areas that interest me. Usually they are areas that I haven't really worked heavily in, so I know I need to learn. One of them I was interested in was social media, because that is not something we are encouraged as cybersecurity engineers to focus on. There is a lot of



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literature that is coming out now that is really looking at the weaponization of social media. I was exploring, there is a book called *LikeWar*, and I think there are several others that are similar to that. That just happened to be the title I picked up to read. But it starts to give you a sense of what can go wrong and maybe challenge you to think a little differently about what you are doing and how you are doing it.

Another area that is very useful is decision making. *What drives decision makers?* Because ultimately you use technology to support you to do something. *Is the information organized and displayed in a way that you can see the logical methods?* There is a lot of research there. [\[Edward\] Tufte](#) is one of the authors that has done a lot of work in that in terms of, *How do you organize material of a high complexity in a way that somebody can make decisions about it?*

Suzanne: That are relevant. I did a class with a professor over on campus, this is way back in the '90s. The one thing I really remember out of that is he did this little exercise where he took the same data. So, *80 percent of people lived through this epidemic*, right? Everybody did a perception rating on were they effective in containing the epidemic. Then he just flipped it and said, *20 percent of the population died in this epidemic*. Exactly the same data but the framing he did was, *What's your perception of it?* There were notable differences in the perception. You think about how that gets insidiously interjected into social media, into the way that information is just presented all around us. Yes, that is a lot to think about.

Carol: There is the piece too where we are hearing a lot now about the bias in the data. The data per se is not bias. The way it is organized, presented, and the decisions that are driven from that data that is where the bias enters it...

Suzanne: We don't always make appropriate decisions from a certain set of data.

Carol: It can be the technology making those choices or it can be humans. Ultimately it all goes down to somebody programmed the system to present the data in a certain way or set up certain decision-making processes within a system. We are working through it, and hopefully it is useful to us and not something we are working against.

Suzanne: All of those things are things that you think about on a regular basis, so people that would be getting into this field would have the opportunity to think about those kinds of things as well. I always like to talk a little bit about personal things. I happen to know that you are one of the few people that are in my circle that actually have done transatlantic crossings on a fairly regular basis, but not on a plane, on a ship.

Carol: I have done both.



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Suzanne: But the ship part, I mean people do the transatlantic much more frequently flying. What is it about transatlantic ocean crossing that attracts you?

Carol: Well, if you have been working very hard, and you really want to get away, there is nothing like seven or eight days of total care. And, you can do whatever you want to.

Suzanne: Nowhere to go. It is just water, right?

Carol: It's not so much there is nowhere to go. I mean you are on a floating city. I don't want to transatlantic on a little bitty ship. I want a big one that has got a lot of space and a lot of things going on. There are activities if you want to. One of the crossings I think we slept like 10 hours. Then you go to dinner, and you sleep some more, and back up for breakfast. That to me is a very relaxing way to work. I also did a transpacific cruise. We did one of the transfer cruises that came out of Alaska, and the ship went over to Japan. The joy of that one was I was writing a book at the time, and I was totally isolated. I had nothing to do in the morning except sit and work on my book. Then I would sign on to the satellite, upload the changes, sign off, and nobody could find me.

Suzanne: So, you could work and not work.

Carol: That is right. You could control your own schedule. There is nothing like having a full staff of chefs to do anything that might suit you and a wine cellar that whatever your little heart desires is there. I won't say I abuse it, but we enjoy it.

Suzanne: Everybody that I talk to has something unique. I actually have to say that I have never been attracted to cruising, like the Caribbean thing or anything, but there is some charm to that, being just quiet and isolated for a little while, away from the rest of the world.

Carol: One of my favorite spots on the ship is that there is a library, and you have got a panoramic view of the ocean. There is nothing like sitting there and seeing nothing for hours to be very therapeutic.

Suzanne: OK, all right. Well I thank you for sharing that with us, and thank you for sharing your ideas on both your own journey and giving some of our listeners some ideas about why they might want to get into this field. Because I think that is... The *why* of this is one of the things that you have to decide that this is really something that is worth your time and worth considering when you have all the choices that many of our young people have today.

Carol: There is one other thing to think about it. It is not repetitive. The field is constantly changing. If you like challenges, if you don't do well with repetitive tasks, and I never did, then you are looking for something that is always going to be interesting, new problems to solve and feel very needed.



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Suzanne: If I look at [your publications list](#), it is a very wide swath of things. You are much more broad. You get deep from time to time with the things when you need to, but you haven't been in the same piece of the field, just in the whole time you have been at the SEI. I am the same way. I have had four or five different careers since I've been at the SEI.

Carol: Yes, it is constantly changing.

Suzanne: Excellent. We will have in the transcripts some [references back to some of your work](#). I want to thank you very much for joining us today. It is always exciting to talk to my friends and colleagues about, sort of, how they got here. I always learn something new in terms of what you are doing. I really thank you for spending the time with us today.

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