

**Oral History Interview with
Susan Landau
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Video Conference**

**Conducted by Jeffrey Yost
Charles Babbage Institute**

Abstract:

This oral history interview is sponsored by NSF 2202484 “Mining a Useable Past: Perspectives, Paradoxes, and Possibilities with Security and Privacy,” at the Charles Babbage Institute. Professor Susan Landau begins with her experience at Bronx Science High School, and its strong influence on her. She then moves on to her undergraduate days at Princeton. She relates how she shifted from Math to Computer Science during her graduate studies at Cornell and then went on to MIT to earn her Ph.D. in Theoretical Computer Science. Landau comments on the gendered environments and sexism at these schools. It is a theme in her later discussing her motivation for founding the ResearchHers email list.

Landau became an Assistant Professor of Computer Science within the Math Department at Wesleyan. She discusses the evolution of her research during her early years as an academic—this includes the Landau’s Algorithm for “de-nesting” radicals. Landau provides context for her thought about mathematical applications to cryptography, the state of art of privacy with regard to cryptography in the mid-1970s, the book *Privacy on the Line: The Politics of Wiretapping and Encryption* co-authored with Whitfield Diffie, and her book *People Count*.

Landau then turns to her years at Sun Microsystems in the 1990s, including the establishment of the principles for Digital Rights Management and DRM Project DReaM. Landau discusses her transition to Radcliffe Institute, Google, Worcester Polytech, and finally, her long tenure and current home at Tufts University. This includes her elaborating on founding a Master’s Program in Cybersecurity and Public Policy there. She highlights recollections of her encounter with famed physicist Joseph Rotblat and his influence on her life. She also relates her longtime collaboration with Steve Bellovin and Matt Blaze at the intersection of tech, security and privacy, policy, and law. She contextualizes her testimony before Congress with the Apple 2015, 2016 (Encryption Dispute—should Apple be forced to unlock its encryption to authorities/FBI) case. And she also comments on a variety of issues including state-sponsored hacking capabilities, the great importance of communicating with broader audiences, and her style and approach in mentoring graduate students.

Keywords:

Security, privacy, computer science, gender, Tufts University wiretapping, encryption, Landau’s Algorithm, *Privacy on the Line*, *People Count*, Whitfield Diffie, wiretapping, Sun Microsystems, Digital Rights Management (DRM), cybersecurity and public policy, ResearchHers, Radcliffe Institute, Google, Worcester Polytech, Tufts, Steve Bellovin, Matt Blaze, Apple.

Yost: My name is Jeffrey Yost, and it's June 27th, 2023. This is an interview for the Charles Babbage Institute's National Science Foundation funded project, "Mining a Usable Path: Perspectives, Paradoxes, and Possibilities in Security and Privacy." I'm here this afternoon with mathematician, engineer, and policy expert on security and privacy, Susan Landau. She is Bridge Professor in Cybersecurity and Policy at the Fletcher School of Law and Diplomacy and the Department of Computer Science in the School of Engineering at Tufts University. I'm in Minneapolis, Minnesota, and presumably, you're in the Boston metro. This is an oral history being conducted over Zoom and being recorded to facilitate a transcription that you will have an opportunity to edit. I'll begin with a few basic questions.

Yost: I see that you were born in New York, and you attended Bronx Science. Can you tell me about your experience at that school?

Landau: Sure. I actually think that my ability to become a scientist is due to both Bronx Science and the National Science Foundation's Summer Math Program I went to after my junior year of high school. I went to New York City public schools. In seventh grade, I went to Hunter College High School, which, at that time, was all girls. I felt like I wasn't getting enough of a math and science education, which, turned out to be true. Years later, when I went back for a visit, I talked to one of the teachers there who told me the school would be much better in math once boys started the following year. I realized that my instincts were right. In any case, I went to Bronx Science, and it was wonderful. I had other students who were interested in math and science around me.

Sometimes, it could be a bit intimidating because there were a lot of very bright kids around me. I didn't always think of myself as a really strong mathematician because I met lots of kids in my high school who were strong mathematicians. I had challenging work in my courses. I really enjoyed the math team. I became captain of the math team my senior year, and then I went to this summer math program at Hampshire College in 1971. That was absolutely wonderful. Then I went back to teaching for a number of years, and that's where I really learned how to teach. It also taught me about computational mathematics, which turned out to be, when I did technical research, the research that I did.

Yost: Can you tell me your decision to attend Princeton University?

Landau: That was due to pressure from my parents who were immigrants and had heard of Princeton and not of other colleges. I had not wanted to apply. I had not wanted to go. I found it, both as a

woman in mathematics and as Jewish in the 1970s, a difficult place to be. The Math Department was very much not encouraging of women.

A funny story about that is that the only bathrooms for women in the tall Fine Tower [the mathematics building] were in the basement, which was the library was and where they had women librarians, and on the third floor, where there were women secretaries.

A slightly less funny story is the time that I went to go to the Go Club, and that was held in the evenings. I opened the door, and it was a room full of male faculty and male students, and they all gaped at me, and I fled.

There was a fair amount of sexism, I guess, is what I would say, and it made it difficult. In some sense, I felt I became a mathematician in spite of Princeton rather than because of it. There are more women in the faculty now. At least a conversation from 15 years ago with senior administrator at Princeton and reading essays about women in math at Princeton 20 years ago or so, the school hadn't changed as much as I think it ought to have.

Yost: I understand you did a senior thesis called, "Simple Algebras." Can you tell me about that?

Landau: Yes, it's been a long time since I have thought of anything like that. Instead, I will tell you about the mathematician, who was my advisor. Princeton had an unusual circumstance. When I was there, they didn't teach first year graduate courses in the Math Department. The [advanced] graduate courses were largely taught by the senior faculty because they were looking for PhD students. The junior faculty who wouldn't stay there—they didn't get tenure there typically—taught a calculus course or a linear algebra course and then an upper-level course.

As a math major, you didn't run into very many senior faculty in your courses. There were exceptions, and one of them was John Moore, who tended to talk very slowly. I had avoided him for three semesters at Princeton. In the fourth semester, he was the only one teaching a course in the second semester on complex analysis that I had wanted to take. I took it from him, and I discovered that he would talk equally slowly when multiplying matrices or about semi-simple algebras or anything else. It was just a certain amount of time. I got to really like him.

I took a course from him my senior year in which we had three classes a week. Two of them, he lectured, and one of them was the problem session, in which he gave us assignments from a book where he wasn't lecturing on anything in the book. We really learned two courses at once. I did my senior thesis with him, and he was kind and generous and fairly unusual because most mathematicians at Princeton did not have senior theses to advise; that's because most of the [undergraduate] students didn't know the senior faculty. John Moore was an exception. Robert Gunning was an exception. There were a few exceptions. By and large, the senior faculty were not involved with the math majors.

Yost: Did you have occasion to make much use of the computer center at Princeton? Did you have an introduction to computing at Princeton?

Landau: I took a course in computer science when I was in high school with an IBM mainframe and a cold start card and all of that. I knew a little bit of programming, and I remember I did a tiny bit of programming when I was an undergraduate. No, there was no CS major at the time, and I thought of computer science as programming, and it was not terribly interesting to me. In science, I like theory, and practice is somewhat less fun. That's not completely true because I do like computational mathematics, but it's computational algebra rather than computational fluid dynamics. No, I didn't have any acquaintance with it then, although my sophomore-year roommate constructed an independent study that was a CS major because there was no CS major at the time.

I can say one more thing about my undergraduate experience, which is that I decided to start an undergraduate math lecture series, and the Math Department was not terribly excited about this. They told me that nobody would come, nobody was interested. But they gave me some money to create posters and put them up. The first talk, we had 60 students. The second talk, we had 70. Then I went away in my junior year, which I spent in England. The person who took over from me told me that he had trouble getting speakers, which I thought was he just wasn't trying very hard. I came back and had to ask seven faculty members before I found somebody who would speak. Then there was a Math Department advisory committee meeting, and the undergraduates were invited to come. This is a story about me as much as anything. I showed up late because I'd been at volleyball practice, and so I didn't know who the mathematicians were on the board.

I explained what had happened about this lecture series. Somebody came up to me afterwards, a tall mathematician. He offered that he would speak in my lecture series, I said, "That's wonderful, but I don't know who you are." He said, "Well, I'm John Milner," who is a very famous mathematician. Of course, as a 21-year-old math major, I was completely flummoxed. I said, "I know you. I mean, I know who you are. Yes, yes." He did speak. The series continued that year, but it was one more instance at the Math Department less interested in undergraduate teaching than I would have thought because there were, in fact, a number of very smart math students at Princeton.

Yost: As you were finishing up your bachelor's in math in 1976, what were you thinking about in terms of your career?

Landau: I thought about science writing, but I didn't have a whole lot of experience in writing. I applied to a few science museums, and I got offered an internship. I applied to the National Bureau of Standards and got offered a position, and I applied to graduate school in Math. I really didn't know what I wanted to do. When I was finally left with all those choices, I did something somewhat foolish. I said, "Oh, I'd rather spend next year studying mathematics than working on this problem that the Bureau of Standards will have me do." You don't make a decision to go to graduate school on the basis of what you want to do the following year, but I did.

I started off in graduate school at Cornell in Math. Then, my second year, I ended up taking a course in algorithms, which I actually dropped out of partway through because I had had no background. That is, I took the graduate course first, and then I instead realized maybe I should take the undergraduate course. That's when I met John Hopcroft, whom I really liked and who was extremely kind and generous towards me. That worked out extremely well for me. I ended up moving from math to computer science while in graduate school.

Yost: Was the gender environment different at Cornell than Princeton?

Landau: Nope. Now, I have to think about how much I want to say. There was a fair bit of sexism in the Math Department. I started off in mathematics. I was going to take oral exams in mathematics. I realized that was not going to be successful, not because of what I could or couldn't do, but because of the particular faculty involved. I decided not to do it. I began working with Hopcroft after I had been at Cornell for two years. In working with Hopcroft for a year, I hit the place where many graduate students hit, which is, "Oh,

I'm going to be here forever and will never finish." I decided to leave. Hopcroft made me take oral exams.

He made me take oral exams because he wanted me to be able to do a thesis in absentia if I wanted to. Obviously, he couldn't make me do it, but he pressed hard. He also wanted to be sure that I could do [a PhD} either in theoretical computer science or in mathematics. I took those exams, and I passed.

As I was leaving, I talked to the Math Department ombudsman about my experience with the particular faculty member [who had exhibited sexist behavior]. As I finished describing it, the ombudsman said, "Oh. We all know he's sexist, but that's his own personal issue." I remember telling that story many years later to a group of graduate students and postdocs in Boston, and the whole room gasped. This was in the 2000s, and I explained, "Well, that was 1979, and that's the way the world worked then." Then I ended up back in graduate school a year later unexpectedly, and I did a thesis in theoretical computer science, albeit in the Applied Mathematics part of the Mathematics Department at MIT.

Yost:

Can you tell me about that program and that environment?

Landau:

Sure. First, I should tell you how I got in there, which is that *The New York Times* had started running science articles, had started a science section, and so I decided to write something on primes and cryptography. I called somebody [this was Gary Miller] at MIT to get a quote, and he wanted to know after I told him he could answer me fairly technically, why he could answer a *New York Times* freelance writer fairly technically. I explained I had talked about his PhD thesis at both the algebra and computer science seminars at Cornell the previous year.

Gary had been looking for a student who knew both algebra and theoretical computer science. Of course, there were math students, and there were CS students. Never the twain shall meet. By the end of the conversation, Gary was offering me funding to come and work with him. Obviously, I first had to apply, so I applied. Within two weeks, I applied. Two weeks after that, I was in, and two weeks after that I was in with funding.

I was in the Math Department. I had come in ready to do a thesis, and that was why I was accepted into Mathematics rather than Computer Science because in Computer Science, I would have had to do a master's thesis. The rationale was that I was ready to do my Ph.D. thesis, let me go into math. In fact, the first part of my thesis would have been a nice Master's thesis, but we didn't know that

because I hadn't done it yet. I didn't run into particular sexism issues, although at MIT, my advisor did continue to introduce me as married to another theoretical computer scientist, which in those days made it difficult to find a position.

People in a two-body problem were not looked upon favorably. He wasn't the only one doing it. I remember showing up at a conference and being introduced as Mrs., with my husband's last name. Then I said, "No, no. I have kept my name." Then my husband was introduced with my last name. My advisor was telling people [I was married and thus hiring would become difficult], but many other people were doing that as well. I remember one of my friends at Cornell was job hunting, and someone called her advisor and said, "Is she married?" He said, "No, but she has a fiancé at such and such place." It was very common to do that kind of discrimination.

There was a report by the women in the Laboratory for Computer Science on a chilly climate for women in Computer Science. I met with those women; it was done by graduate students. I met with them, but I did not actually sign the report because I was officially in the Math Department. It felt awkward for me to do so. Some of them described difficult situations. I had started graduate school not wearing my wedding band, and then I realized that it made other graduates, male graduate students, more comfortable if I was wearing a wedding band. I started wearing it, but it was really to make them more comfortable. It wasn't for me. It was a very different climate then.

Yost: Your dissertation, which you defended in 1983, was entitled, "On Computing Galois Groups and its Application to Solvability by Radicals." Can you tell me about how you came to this dissertation topic?

Landau: Sure. Gary was very interested in algebraic problems, as was I. What I really wanted to do was fast algorithms for polynomial factorization. That's what I was working on. Then I got scooped by Lenstra–Lenstra–Lovász who came up with that probably spring of 1982. I was taking a class in symbolic computation in the spring of 1982. The professor, Rich Zippel, had just shown us how you could reduce the problem of factorization in an algebraic number field to factorization over the rationals over a smaller field. This is actually work due to Kronecker from the 19th century.

The point was that the particular algorithm he showed us was a polynomial time reduction. I raised my hand, and I said, "Then you can factor polynomials in polynomial time using Lenstra–Lenstra–

Lovász. Rich said, “No,” and I said, “Yes,” and he said, “No,” and I said, “Yes.” He said, “Will you let me teach my class?” I said, “Yes.” Then at the end of class, I walked up to him, and he said, “You’re right.” We didn’t even talk. He just said, “You’re right.”

That became what would have been my master’s thesis, but it became my first paper. Then, with that, it became interesting to look at Galois groups and what you could learn about Galois groups. There was a result by Patty on primitive solvable groups. That plus the fast factorization gave the result for my Ph.D. thesis. That was all very fast. I proved the result in Rich’s class probably April ’82, and I defended my PhD. in January or early February ’83.

Yost: MIT, of course, was a pioneer in computer time-sharing with CTSS and then Multics. Did you use the Multics system?

Landau: I was a theoretical computer scientist. It’s probably not appropriate to say I hate programming, but I’m not a programmer. When I used to teach at my NSF summer math program, I would debug students’ programs in languages that I had never programmed in. I successfully debugged their programs, and I certainly wrote pseudo programs for my thesis. I did computations in Maxima and then Maple for research I did. I certainly used tools; I taught a database course. No, I didn’t take a database course as a graduate student.

Because I was in the Math Department, I was pushed to take math courses rather than CS courses. In that way, it would have been better for me to have done a Ph.D. in the Laboratory for Computer Science. Gary had a dual or courtesy appointment; I think he could have advised me in LCS. Long term, it would have been better for me to take various CS courses. Instead, I had to take various Math Department courses. Don’t misunderstand. I really enjoy mathematics. No, I didn’t participate in Multics. I think probably the first time I really heard about Multics in any way that it sunk in was from Peter Neumann many years later.

Yost: You completed your doctorate in 1983, and you took an Assistant Professor position in the Computer Science Department at Wesleyan?

Landau: I was hired as an Assistant Professor of Computer Science but within the Mathematics Department at Wesleyan.

Yost: Can you tell me about your job search and your decision?

Landau:

Sure. I'm married to a complexity theorist, Neil Immerman. I think we didn't think as carefully about our job hunt as we might have. We didn't really think about how to solve two-body problems. Neil had been in the middle of his job hunt when I got the potential [of an offer] and then the offer of going to MIT [as a PhD student]. We had already planned to get married. I messed up his job hunt by taking the offer of going to graduate school at MIT. He ended up backing out of a faculty position and going to a position at Tufts with a heavier teaching load than he anticipated—and he was without research colleagues.

When I finished my PhD, it was fairly important to him, perhaps even more important to me, that he would be in a position where he could regain that lost time in some way or another. When I say we didn't think carefully long term, there was somebody at Yale whom he really wanted to work with. He had applied for an NSF graduate fellowship. I really liked the people at Wesleyan. I had been a little burned between Cornell and the job hunt from MIT and the sexism in both places. There was a fair bit of sexism at Cornell, not just from the faculty, but from the graduate students as well. I thought being in a smaller place would be good for me. I also knew that at that time, being in the same department as one's husband was not great.

It's now not uncommon to hire two members of a couple. At that time, it was very difficult for the woman who would be constantly compared. In Neil's case, he'd finished three years ahead of me, so there was going to be a gap. I didn't want to be in the same institution. Yale and Wesleyan worked for us. We did a relatively short job search.

A faculty member had written me a letter urging me to apply to his institution (in those days, people did letters, not email). I applied, and then they never reached out for an interview. I wondered what had happened, what were my letters like? Then later, I found out from this faculty member where they had one job, and they knew I was married. There were all sorts of weirdness that still went on at that time, probably still today, too, but they're more disguised and less frequent.

Yale and Wesleyan, Yale gave Neil the person to work with that he wanted to. It had us in different institutions. It had me in a place that felt very good, and people were very welcoming, so we decided to do it. We didn't think long term about the fact that Yale, at that time, didn't tenure junior faculty, or that I would be in a somewhat isolated situation intellectually. And that the next job

hunt would be harder. We hadn't thought that one through as much as we should have.

Yost: I understand that during part of that time you had visiting positions at Yale in the Mathematical Science Research Institute.

Landau: Dick Karp, who was encouraging of women, had come by to give a talk at Yale. He told me there was going to be a special year at the Mathematical Sciences Research Institute, maybe a year on complexity and a half year on algebraic algorithms or some combination like that. Neil could go easily because he had an NSF postdoc. I didn't. Dick encouraged me to apply for a fellowship. That was one semester. Then I applied for an NSF postdoctoral fellowship at the very last time I was eligible, which was five years after my PhD.

I did that because we had one child, and we were expecting another. I wanted time to spend with the children when they were small but also to do my research. That seemed like a way to do both. When I got the fellowship, NSF allowed me to put it off a bit but told me I had to start it that first fall. I did it half time because our daughter was three months old and then saved the rest for the following year and years.

Yost: In 1989, you developed the first algorithm for deciding which nested radicals can be de-nested, which is known as Landau's Algorithm. Can you tell me about the context for that? What was the impact and the response to this work?

Landau: What I want to say is, many years later, I wrote a short article for the *Math Intelligencer*. Let me start with an example; I'll write it for you so you can see it. It's the square root of five plus two root six equals root two plus root three. Can you see that, or should I do it in a deeper pen?

Yost: If you move it up a little bit, yes.

Landau: It's not hard to believe this because if you square the top line, you get five plus two root six. If you square the bottom line, you get two plus three plus two times root two times root three, which is five plus two root six. Okay.

This equation is a nested radical. It turned out that all of the biggest results I had done in algebraic problems, polynomial factorization, solvability by radicals, decomposition, which I did with Dexter Kozen and de-nesting, had a nice explanation with this particular equation. That example told me, really, understanding computation is important.

Before I got pregnant, a colleague had said to me that the best time she had for doing mathematics was her middle trimester. During both the first and the second pregnancy, I kept waiting for a good time for mathematics, and it never happened. I did find in both pregnancies that three months after the baby was born was actually a really fruitful time. I was getting enough sleep. I think my brain was no longer cluttered with hormones.

I actually did pieces of work that I was very proud of decomposition after our first child was born and this happened again after our second. I was reading a paper, actually, also by Rich Zippel. I said, "Wait, there's a problem here," or, "I think I can do better." I began playing around with it. I don't know if it's gotten a lot of attention, but it was a piece of mathematics and computer science I was very pleased with.

Yost: During your time at Wesleyan, were you thinking a lot about mathematical applications to cryptography?

Landau: I had always had an interest in that. In fact, the decomposition of polynomials, which I did with Dexter Kozen, turns out to show that a proposed cryptosystem based on polynomial composition won't work because there's too fast a way to decompose. That was where the isolation of being at Wesleyan mattered. Remember, we didn't have Zoom; we didn't have Skype; we didn't have fast email. We didn't have lots of things that we have now. I did do one joint piece of work with a colleague in England, which we started when I was visiting him, and then we finished long distance. I had interests in cryptography, but I wasn't in a position to comfortably pursue them. That is to say, I wasn't around the right kind of stimulation and the right kind of colleagues to do it with.

Yost: The 1980s were kind of impactful and in the mid-70s, 1976, there's the landmark *New Directions in Cryptography* paper of Diffie and Hellman. Then at the start of the 80s, you get the Data Encryption Standard.

Landau: You got the Data Encryption Standard at the same time in '77, I think, that it's approved.

Yost: Right, my error, 1977 [approved Nov. 1976, first published 15 Jan 1977 FIB Pub 46]. Were you thinking about privacy with regard to cryptography at all?

Landau: When I was a graduate student, I took Joe Weizenbaum's course at MIT. He had already written *Computer Power and Human Reason*, which I had read when I was visiting a friend in England who lent

it to me. I took Joe's course. When I got to Wesleyan, one of the attractions to me at Wesleyan was that I could teach a course on social aspects of computing. I don't have my course notes from then, but I do know that I had them read the Brandeis and Warren paper [on privacy, a fundamental work]. I suspect I had them read Prosser's paper on torts, although I don't remember for sure.

I talked about social impact issues. The other things that I was thinking about when I was a graduate student at MIT, the *Notices of the American Mathematical Society* started running survey articles in the *Notices*. Now, the *Notices* had been just something of a professional journal: When are the meetings? What fellowships are available? How many people are getting PhDs? and that sort of data. They started running these survey articles. When I say "survey articles," they were accessible to second-year graduate students.

I proposed one on primes and cryptography. Ron Graham said, "No, no, no. Many people know about public key cryptography." Ron said. I said, "How about if I write something about the policy issues, too?" He said, "Fine." I did that.

That was in 1982, just as I was beginning my job hunt. I remember I got to Wesleyan, and they had it up on the bulletin board as I came off the elevators, which was very pleasing. Then in '87, you asked me about programming, I decided to write about symbolic computation systems again for the *Notices*. What I looked at was how fast it is to factor polynomials. I ran some experiments about if you take multivariate polynomials, how long does it take to factor a multivariate polynomial with so many variables? How about so many plus-one variables? You went from a reasonable amount of time to it just didn't happen.

Then the following year, Adi Shamir had done zero knowledge. I'm going to have to go back and check that. He put in for a patent and said it might have possible military applications.

He was in Israel at the time, and he did the work with some graduate students. I'm not going to remember which unit of the U.S. military. I think it's the army, but I'm not sure. I'd have to go check—they put it, slapped a secrecy order on it. Then the order got lifted apparently through help from the NSA, but all of that is apparently [nothing was ever said publicly]. I decided to write an article for the *Notices* about that.

It's always a little bit awkward when I do that because I have to call people who I'm colleagues with as professional colleagues and

say, “Hi, it’s Susan Landau. I’m calling you, and I’m writing an article.” It’s like a journalist. You have to talk to me that way. I did that piece, too. By then, I had done two papers on the policy aspects of cryptography. Through all of that, and even before that, as an undergraduate, I had taken a course in constitutional law. I have always had a strong abiding interest in privacy for as long as I can remember.

I’ll say that when I got appointed Distinguished Engineer at Sun, I decided the present I would buy myself was a copy of several volumes from the Church Committee hearings.

Yost: You were coauthor of a landmark book on privacy, *Privacy on the Line: The Politics of Wiretapping and Encryption* with Whitfield Diffie. When did you first meet Whitfield Diffie? Can you talk about the context for coming together for that book?

Landau: I think I met Whit in 1988, but I’m not sure, at a meeting in D.C. I met him again in the early ‘90s at the crypto conference. Then when the Clipper Chip came out, USACM, which was a newly constituted committee of the ACM, decided to put together a policy study on the Clipper Chip and related issues. At that point, we had moved, and the position that I thought I was going to have after several years did not appear. This was not an unusual thing for the trailing female spouse. Barbara Simons, who was Chair of USACM, knew about my situation and suggested that I be staff for this report.

Now, I was 10 years past my PhD. I had a number of NSF grants. I had a lot of published papers in these fancy conferences and so on. [Being a staff member to the committee] was a step down for me, but I decided to do it because I thought it would be interesting. Whit was on the committee; Peter Neumann was on the committee, as was Dorothy Denning; Clint Brooks, who was assistant to the director of NSA. At the first meeting, I behaved like a staff person. I handed out a sheet with everybody’s addresses, phone numbers, and email addresses. By the second meeting, the committee had decided that instead of my stapling together the chapters, I would write the report. Then I became the first author.

Any committee report suffers from toning down the conclusions so that everybody agrees with them. This one was a particularly divisive report, and there were some people who objected to certain pieces. There was a lot of toning down in places. Whit said to me afterwards, “Hey, let’s take,” and I can’t remember if he said three or six months and rewrite it properly as a book. Then I wasn’t sure [about doing the book], and then he wasn’t sure. Then one

day, I came home, and he had FedExed me a telephone security device to encrypt our conversations. The device was unnecessary, but he wanted me to practice using it so that I would know what the technology was like. It's still on my desk now. We wrote the book.

Yost: Can you talk about that process? Were your ideas on privacy pretty closely aligned, or were there debates and a lot of discussion?

Landau: Whit had a lot more experience than I in pitching his ideas. Whit is also an extremely deep thinker, so he asks "why" a lot. I can certainly think of places where he asked why where I hadn't thought about it. There are also plenty of places I asked why where he hadn't thought of it. It was not all one way. If I look at the book now, I see ways we could have written it a lot better, but I know a lot more now than I did then. The title is *Privacy on the Line*. It's really about wiretapping and encryption policy rather than privacy, or rather, it's on privacy of communications as opposed to privacy more generally.

College is supposed to teach you how to think, not about specific facts, but about how to think. I learned a lot writing the book. I learned more writing other papers and other books. I have never taken a formal course in privacy. Whit certainly hasn't. We learned on the line, as it were, and talking to people. Whit is a schmoozer, and I'm not as much of a schmoozer as he is, but I certainly am willing to say to people, "Wait, I don't understand. Could you explain that a different way?"

Yost: What was the early reception to the book?

Landau: That's a long time ago. I remember we were on NPR the week it came out for an hour-long program [Talk of the Nation]. Neil Conan is who did it. The reception was quite positive, so it was very heady. The book won a couple of awards, which were also very heady.

Then six or eight months after the book came out when my husband and I were still in the middle of academic job hunting, Whit called me up one morning and said, "When can you start?" I said he said, "Huh?" He said, "When can you start?" I said, "What are you talking about?" He said, "We're going to make you an offer of a job. When can you start?" He had gotten Sun to agree to hire me remotely, which in 1998 was somewhat unusual.

I started working for Sun, and I'm not sure what they expected. They hired me to be one-third of technical of interest to me, one-

third technical of interest to them, and one-third policy. Within about five years, I realized that I was doing almost entirely policy. They were happy; I was happy, and so it stayed.

Yost: Even though it was remote, did you have occasion to spend some time at Sun out in California?

Landau: Yes, I went out fairly often. My first few years while I was a Senior Staff Engineer, I would go out for between about 10 days maybe every 2 to 3 months. Then when I became a Distinguished Engineer, I started going out a little bit more frequently, but shorter visits, so five or six days, six or seven days, actually, for every six weeks to two months. I would have packed weeks, and then I would come home and digest it sitting in my house in western Massachusetts, taking long walks with the dog and thinking.

Yost: I understand that you teamed up with Chief Technology Officer Greg Papadopoulos to establish Sun's principles of digital rights management and the DRM Project DReaM. Can you tell me about that?

Landau: Sure. Whit and I had done various things on encryption and wiretapping. I had done some stuff on identity management, and I was looking around for a new project. I think Whit must have suggested that I talk to Greg. I remember reaching out to Greg, and he was several levels above me because I had a manager and a head of the labs, and then there's Greg. He said, "Well, I have some pretty strong ideas about digital rights management," and he told me what they were, and they seemed quite amenable. The first thing I did was preparing a background briefing paper on the history of copyright and digital rights management to sort of set the stage. We were doing a little bit of a skunks-work project in the sense that we were not clearing it with public policy. We were doing the policy that made sense for Sun, which is, of course, the policy that the Chief Technology Officer is responsible for.

I don't think the public policy person was all that thrilled with us because, of course, it created quite a lot of noise. I remember I talked to one of our media customers who proceeded to call us all "dot commies," which I actually thought was kind of cute. I told salesmen after that that they probably should not put me on calls, although there were times when we held one meeting with media companies. One of our more techie folks said things that got the media folks quite upset. I'm a little bit better at steering in the middle, so I got up and spoke next, and everybody thought I was a lawyer, which I was not. That calmed things down.

Working with Greg was a lot of fun, and I was really proud of the policy we came up with. I briefed it to people in Washington as well as in Brussels. We were unusual for a tech company taking that stance at that time. It's part of what made me proud to be at Sun.

Yost: I have asked you some questions about gender and academia. What was the environment like at Sun in terms of the gender environment?

Landau: Really easy for me, but I came in as a Senior Staff Privacy Engineer and then was promoted to Distinguished Engineer. I was working with Whit. I came in with a whole lot of protection around me. I heard things from other people that indicated they weren't as great as I found it. I think I came in with just this aura around me which made it easier.

Yost: You came in right near the height of the dotcom bubble in '99 and then in 2000, the burst of the bubble. Did that create difficult times at Sun?

Landau: Sure. When I arrived, I would go into the office in eastern Massachusetts once a week for a while, just as a way to get to know people and connect. I wasn't reporting through eastern Mass, I think that was through California, but I would go in. The second time I went in, we had moved to this new facility that had been built for Sun. A year later, we started doing layoffs. It was disturbing to see these things happening, worrisome at times. There were times that people I really liked were suddenly laid off.

I remember that this was a time when people's email addresses tended to be their work mail addresses. Suddenly, somebody would get a notice on a Tuesday that they were done. They realized nobody knew how to reach them because their email was gone. That was a function of the times and how we did things. We, that is, Sun, were beginning to turn around by 2008. My sense has always been that if the recession had hit at a somewhat later time, maybe we could have turned things around. I don't know. We didn't, and it was gone.

It was still, for me, a wonderful place to work. I learned a tremendous amount. People were very giving of their time. They were really smart people to talk with. Partially, I got introduced through Whit. Partially, I got introduced through me. It was an amazing place. Even though it was dying, it was an amazing place. Here's an example of amazing. We had three mailing lists that I was on, probably more than that.

The three that I am going to talk about, there was a security-interest mailing list in which you said, "I have to configure X, but I'm not sure how to do it." There was a second one that included the first one that said, "I need to design a whole system to do X." Then there was that plus politics, so all three. You could sign up for the lowest one, the next, or all three. When Sun folded, somebody created a mailing list of all three. It still exists today, 13 years after the company's gone, with occasional political discussion, sometimes configuration discussions. Sometimes, it's "I'm looking for a consultant," and it's amazing to have that [kind of connection] happen that long after.

Yost: Speaking of email lists, can you tell me when in the context for your starting the ResearchHers email list to support women new to research and computing?

Landau: The Computing Research Association, which is an organization of academics, supporting academic computer science departments and perhaps also research labs, had been all about academia. In probably 2003, the committee focused on women decided they wanted to expand to include industry. They invited a few of us to brainstorm with them for a couple of days. One thing that I thought was useful was the idea of a mailing list. They were supportive of that, so I created the ResearchHers list. We had some interesting discussions on it. It started shortly before the growth of social media, 10 years later, it had so much less traffic that, I had by then handed it off, that it essentially died.

The list was a way of linking together women from research labs, women from academia, and women from government labs. I think that was pretty important. CRA-W, which was the organization devoted to women is now broader organization that includes all underrepresented peoples, but CRA-W was organizing various programs for graduate students. It was great to have the ResearchHers list as a resource to find women in industry and women in government who could also come and speak at these events and tell graduate students about potential careers in these other fields. I remember once being at a conference where a keynoter perhaps made some comment about his mother couldn't understand this or his grandmother couldn't understand that. It was fairly common to hear that kind of comment during a talk. Sitting at lunch with two male colleagues, they wanted to know how I would respond to that.

I said, "You know what? I'm going to send mail out to the ResearchHers list and ask people and say that this mail, unlike most mail on the list, is going to go out from the list and ask people how

they respond. I got 15 responses from people, which I shared with the 2 people. Recently, I was talking to a male colleague who was concerned about the lack of women in his department. I happened to mention this particular story, so he asked me could he have those since they were public. They were submitted with the intent that they would be public. I forwarded him on that mail.

Yost:

I understand that Joseph Rotblat had an important influence on your life, and you wrote articles in both *Scientific American* and the *Bulletin of the Atomic Scientists* in 1996 about him. Can you talk about that influence in those publications?

Landau:

Sure. My parents are Polish Jews, who are Holocaust survivors. I was born and grew up in New York City, but it made for a fairly unusual childhood, and maybe adult life as well. First, I need to tell you Rotblat's story. He was born in 1908, and he studied physics in Poland. In 1938, he went to England to work with Chadwick, who's the discoverer of the neutron.

After he'd been there some time, Chadwick offered Rotblat another fellowship, and he decided to bring his wife from Poland. Chadwick said, "Well, you can't afford both of you to live on [the fellowship]." Rotblat said, "Yes, we can." He went back to Warsaw. His wife had an attack of appendicitis and couldn't leave with him. She was going to follow, and then the war broke out. Although he tried in various ways to get her out and find her visas from safe countries, the borders were changing quickly enough that she didn't make it out, and she was killed during the war.

One of the things Rotblat had done when he had gone back to Warsaw in the summer of 1939 was talk to his old thesis advisor because he had done a back of the envelope calculation, as many other people had done after the experiments by Meitner and Kahn, and figured out that an atomic bomb was possible. He asked his advisor what he should do. His advisor said, "You need to make up your own mind." Rotblat came back to England and decided that the Nazis were so evil that it was appropriate to join an atomic bomb project because of the evilness of the Nazis.

In about 1943 or so, the UK had been running an atomic bomb project, and Roosevelt and Churchill had been discussing it. In 1943 or so, they decided to join the two projects and bring the UK project over to the United States, which was a safer place than the UK, as well as a country with much more resources. Chadwick was bringing all of his people over. The U.S. said, "Only people with British passports, with British citizenship can go." Rotblat

had maintained his Polish citizenship so that he might go back to Poland after the war.

When Chadwick got to Los Alamos, he convinced General Groves that Rotblat was important enough to waive that rule. Rotblat came. Rotblat was sufficiently close to Chadwick; I can't remember if he was living with Chadwick at Los Alamos or just coming over for dinner many nights. He spent a lot of time with Chadwick. When D-Day happened on June 6th, 1944, the U.S. had a group of physicists essentially just behind the army the whole time going, crossing into Germany.

The point was that if the US physicists knew what Heisenberg had accomplished, they would know whether or not the Germans had built a bomb. Sometimes, this group of physicists was behind the army tanks, and sometimes, they had gotten ahead of the army tanks. They found Heisenberg. They very quickly determined that the Germans had not succeeded in building a bomb, that they had built essentially a nuclear reactor. That information came back to Los Alamos. Rotblat learned about it in late 1944. In early '45, he left Los Alamos, took a train across the United States and a boat across the ocean, and returned to England because, for him, there was no point working on the bomb project anymore.

He was the only person to leave. He was not allowed to talk about the bomb project, of course, after he left Los Alamos. He was the only person to leave or to express any concerns prior to the experiment in July of 1945 where the physicists saw that it was possible to build an atomic bomb.

Rotblat left nuclear physics. He went into nuclear medicine. For a while, he was sort of shuttled into a corner. In the mid-1950s, in 1956 or '57—I'm not going to remember the exact date—he approached Einstein. Rotblat and Bertrand Russell wrote a letter that scientists should take responsibility for their actions. They got somewhere between 11 and 13 signatories. I haven't looked at that data in a while. One of signatories was Einstein, a few days before Einstein died.

All but Rotblat were Nobel laureates. They published this letter. Then they got various responses to this, including an offer from Canadian industrialist, Cyrus Eaton, who said, "You should have a meeting. If you hold your meeting in my hometown of Pugwash, Nova Scotia, I will fund it." They thought this was a joke because there was a cartoon character named Captain Pugwash, and they figured that they were just being had. After their initial funding fell through, they organized this meeting [in Pugwash, Nova Scotia].

They invited scientists, eminent scientists from around the world to meet as scientists, and no journalists. And they were not there as representatives of their countries. They were the people behind the Nuclear Test Ban Treaty, behind various chemical weapons bans, and so on.

When I was a graduate student at MIT, there was a sign up for a student Pugwash meeting. This was in 1981. The point was that the people in Pugwash were getting older by a year each year, and they decided they needed new blood. I applied and was accepted. Now, I knew the name “Rotblat.” It was one of the names my mother had mentioned when I was growing up.

What she said was that she knew him. I explained that I had been accepted to this thing, and she told me to say hello to him. She had, in fact, known his sister-in-law in hiding during the Warsaw ghetto.

I went to the student Pugwash meeting, and I was overwhelmed by Rotblat. He was someone who lost so much. He lost most of his family during the Holocaust, not just his wife, but others. Here he was doing something for humanity and had dedicated himself morally, scientifically his whole life, and he was really quite amazing. I had interests in science policy before that. I don’t remember when I took Weizenbaum’s course, but I had read Weizenbaum’s book before I met Rotblat, and I had taken various courses in science and technology policy. It is not the standard thing that mathematicians read. I had also thought about being a science journalist.

I had all these sorts of social-impact interests, and I came away just really impressed. For years, I really wanted to write about Rotblat. Finally, I decided he wasn’t getting any younger. Just before we moved with two very young children to Amherst, I decided I was going to do a profile of him, which I did. Of course, I don’t have experience in writing scientific biography or writing biography or writing journalism. I wrote it, and then I sent it out, and it got rejected all over the place. Then six years later, Rotblat won a Nobel Peace Prize.

I called up whoever was doing science, physics journalism for the American Physical Society, and I said, “I have got this piece. What do I do with it?” He told me how to send it out and what to do. Then he said, “Wait, wait. Now you have to tell me about Rotblat because I’m getting all these calls, and I don’t know anything about him.” I sent off the piece to *Bulletin of the Atomic Scientists*. Rotblat won the Nobel Peace Prize. Of course, they knew who

Rotblat was. Here is this profile of him that arrives over the transom a few days later, and they call me up to ask me if I can update it.

I say that I'm sure I could because, after all, I had spent a weekend interviewing Rotblat in Chicago, so I was sure he would give me the time even with the Peace Prize. The Bulletin told me they would accept the piece but on the caveat that other people could use it in various ways, too. They were going to run it, but they, of course, just wanted more about Rotblat to be known. Then I also got a shortened piece into the into *Scientific American*. Rotblat's sense of understanding why you're doing what you're doing is a really important thing, and that has guided me [in decision making] the whole way through my career.

I need to know why I'm doing what I'm doing because, if circumstances change, then I need to rethink. It has caused me, in various ways, to leave positions or not follow certain things which are good for my career. Rotblat's commitment to the world is a really important thing to me.

The other person who had a really big impact on my life was my high school English teacher who, oddly enough, when she retired, became a volunteer at the UN and very quickly began editing *Disarmament Times*. She, in fact, knew Rotblat from a different perspective, but this was years after I had written my piece and so on, years after, somewhat after.

Yost: Fascinating, thanks for sharing that. I understand in 2001, you worked on identity management for the Liberty Alliance, which was an alliance of corporations, universities, and government entities. Can you tell me about that alliance and that work?

Landau: Sure. I should say that was partially an inspired effort by the lab's director. I had been out with breast cancer the year before, and he decided that I, while still not up to my usual energy levels, I needed a new focus. He decided we needed a security review of the identity management, and he would put me in charge partially because he thought I could do it well, but partially to sort of reorient me without even saying so. I think that was a very inspiring thing of Jim's. Sun was one of the leaders on this identity management system.

It was a decentralized system, which was a very Sun thing to do as opposed to the centralized system that Microsoft was doing. That was the period when Sun and Microsoft were really at loggerheads. Here was a technical response to Microsoft that was privacy

protective. My role initially was to conduct a security review, which meant figuring out who should come and what questions should be addressed and then writing it all up. I didn't know how to do that without also describing what Liberty did. I scrambled, and I wrote up what Liberty did for the people who were coming so that they didn't have to go and read all these standardization documents that were in very rough form.

We did a security review. Then sometime later, I got a call, when they were doing Liberty version two, from the security and people from Sun who were part of Liberty version two. They were at a meeting, and they realized the EU would press them about security and privacy and if I could, in six weeks, produce review of the version two. My role at Sun, at that time, was that I was left a lot of the time to pursue things that were of interest to me. Periodically, whether it was the DReaM Project in DRM or the Liberty version one and version two security reviews, periodically, I would be called to say, "Drop everything. You must do this, and it's due in six weeks or two months or three days," or whatever it was. I don't think it was ever three days.

You asked me when I learned about privacy. I think that's when I self-educated myself about various aspects of privacy, that is, the formalism of the fair information practices and so on. Later on, in doing other work, I learned about other aspects of privacy. It was in doing the Liberty reviews in the early 2000s.

I remember being at a technical meeting where somebody presented a criticism of the Liberty standards. It was disturbing to me but also interesting because they were saying, "Here's this technical hole that you could slip a problem through." I thought, "Yes, but the way for handling [the issue] is not technology. It's policy, or it's law."

Yes, you can hit it with a hammer, with all this technology, or you can hit it really lightly with this piece of policy. With some colleagues at Sun, we wrote up a paper which eventually got into a conference that said, "Here are these critiques, but this is the right way to handle it." That formalized my kind of thinking about what's the right method to handle a problem. Is it law? Is it technology? Is it policy?

It's something that's then guided my way through. I teach these students. I developed a Master's Program in Cybersecurity and Public Policy. The fact is that I started in this field before it was a field. Many of these things, no one teaches you. You have to sort of figure it out on your own.

Yost: You mentioned the different positions of Sun and Microsoft. What other corporations were involved with the Liberty Alliance?

Landau: I don't even remember anymore. I remember American Express. There were a lot, but I just don't remember now.

Yost: This is kind of a very broad question. Privacy and security are, of course, different concepts, but interrelated in different contexts, and have different meanings. What do you think are the most important framings of these concepts of security and privacy? Has your thought on the relationship between them evolved markedly over time?

Landau: It hasn't really evolved markedly. I'll give you two different encapsulations, not due to me, which I think are actually the same encapsulation but not said the same. Whit talks about security being, protecting you from things outside and privacy protecting you from things inside. MITRE is doing a privacy taxonomy, and they have this picture of two circles intersecting, the security circle and the privacy circle. They say, "Well, they really want to focus on the piece of the circle that's outside the intersection, that where security protects privacy is really a security problem, and everything else is the privacy problem."

I think that's the right way to capture it. Yes. I remember when Facebook had the thing with Cambridge Analytica, and Zuckerberg was talking all about the security problems and how terrible they felt about the security lapses. I wrote a Lawfare piece—I think it was a Lawfare piece—that said, "This is not a security lapse. This is a privacy lapse." Here's the different way that there are privacy lapses in here.

Yost: Did you go from Sun to becoming a fellow at the Radcliffe Institute?

Landau: Yes.

Yost: Can you talk about that transition and how that came about?

Landau: Sure. I remember in the fall of 2008 being at a meeting at Sun and seeing some senior people at Sun come to the meeting. It was clear from their faces that we were not going to last very long. I made a list of who might write academic letters for me. Then I thought, "No, I'm in the middle of writing a book, and I really like being at Sun. I'm just going to stay at Sun as long as it lasts and finish this book." In fact, Sun lasted another 12 or 14 months from that instant. The second year, it was clear. Oracle had already made an

offer for us, and it was being negotiated at the EU and so on, about antitrust.

I made a list of places for people who might write letters for me, and I applied for very few academic jobs. I applied to the Radcliffe Institute. Sun folded end of January 2010. I finished my book and handed it in at the end of March. Just before I sent it in, I think I had an acceptance letter from the Radcliffe Institute. That seemed like it would be an interesting opportunity, and I wasn't seeing a whole lot of academic positions. I thought that with my background in theoretical computer science and my good publication record and the law review papers, I had begun to write doing policy work, as well as other papers I had written in policy, I would find a position easily.

It turned out in 2010, and for several years afterwards, doing cybersecurity policy was just not a thing. I took the fellowship at the Radcliffe Institute, which turned out to be absolutely wonderful. They had social scientists, humanists, a few performing artists of one sort or another, and painters, and a few scientists and engineers. There was a talk on Mondays just before lunch, a talk Wednesday afternoon, and lunches Monday and Tuesday. Those were the entire responsibilities in this place full of really smart and interesting people.

I did that for a year. You were encouraged to connect with people at Harvard. I started going to some talks at the Kennedy School. I sat in on at least one course at the law school. I gave talks at various places at Harvard. At the end of the year, it had been suggested to me that I spend a year at Harvard, visiting computer science, maybe teaching a freshman seminar, and we would see what Harvard was going to do about cybersecurity policy. It was pretty clear to me fairly early on that nothing was going to happen anytime soon.

I stayed there for that year. I taught a freshman seminar on privacy. The following year, I applied for a Guggenheim Fellowship, which I got. Meanwhile, I was applying for academic jobs. They want you to be a computer scientist, or they want you to be a political scientist. I'm not a political scientist. I'm no longer a computer scientist. If you want to be in the middle, well, the middle doesn't fit in either school. I'm getting a little ahead, so I don't know if you want me to stop, and you ask the next question or not.

Yost: Go ahead.

Landau: In the middle of all this, Google called me. It was not the first time Google called me. It wasn't the second or the third or the fourth. I said, "Look, I'm not a software engineer." They said, "We know you're not a software engineer." I said, "I'm really not a software engineer." They said, "We know. We are actually interested in you." This was, I think, December 2012.

I said, "I have to be down in California actually at Google for a meeting in April, and I'm really busy before April. If you can wait till April, I'm happy to interview then." You can see how much I was blowing Google off. I got down there, and I went out to dinner the night before my interview with Eric Gross, and it was a really nice dinner. We had a very good time, a very enjoyable time talking. The next day, I'm interviewing. I knew there were smart people at Google, and I knew there were interesting problems. What I couldn't tell was how serious they were about privacy. Halfway through the interview, I thought, "They seem to be serious about privacy. I better be serious about this interview."

I got an offer, and the deal was that I was going to work in California for a year to learn people and projects, and then I would work remotely after that, which was pretty unusual for Google at that time. I went out there, rented an apartment, and did many trips with my husband to Ikea, and had one-bedroom apartment there. He went back home. Fairly quickly, I realized that Google's sense of what privacy should be and my sense of privacy were fairly different, and it was not a good match. I left after seven months.

I left on good terms. I still see some of my colleagues. I have still stopped by there a number of times, but it was not the right place for me. Meanwhile, Worcester Polytech opened a position in cybersecurity policy. You could put me down as someone who can't keep a job. I applied for that, and I thought that, "Well, Worcester is within striking distance of home, and plus, there are people I work with in Boston. This will work well."

It's not as much in the middle between home and Boston as I would have liked. I found it less stimulating than I wanted, and I very quickly realized that despite being tenured, it was not the right place for me. Like I said, I can't keep a job. WPI was very nice, and they encouraged me to stay, but it was not the right place for me. Then Tufts had a position.

Yost: Moving back to Google for a moment, can you elaborate on the different vision on privacy?

Landau: I don't think I'm comfortable doing that.

Yost: Okay.

Yost: Sure, fully understand. At WPI, it was a joint appointment?

Landau: No, it wasn't. I was in the Department of Social Science and Policy. After a year, I think they gave me an appointment in Computer Science. It was a zero percent appointment. It was not a joint appointment.

Yost: Okay. You were working at the intersection of law, policy, and computer science?

Landau: Yes, I taught case studies in cybersecurity. I taught a cyber law course. I taught a privacy technology course. I don't remember the fourth course. I could go look it up. I have developed many courses over my career. When did I learn about privacy? In part, of course, when you teach, as you well know.

Yost: Someone that you have partnered with on writing projects is someone I interviewed probably about 10 days ago, Columbia's Steve Bellovin.

Landau: I figured you were going to get there, yes. Steve didn't mention it, but I'll tell him. He's coming to dinner Saturday night, so I'll tell him.

Yost: The two of you are very early in working at this intersection of computer science, law, and policy. Can you talk about collaborating with him? Also, were there other scholars that you would also say have been contributing in major ways to tech law policy that have the technical understanding of computer science like the two of you?

Landau: Matt Blaze is the third of the triumvirate. I began working with Steve and Matt. I had done something about privacy in schools. Peter Neumann asked me to do a column for the back of *CACM*. I thought, "Even though I have a good sense of what I want to say, partnering with Steve and Matt will be fun and interesting." I approached them. I had not worked with them before, and this was a short thing to do. We did it together.

Then, after that, the FBI had been very unhappy about the change in export control laws in regulations in 2000. Even though it happened with the acquiescence of the NSA, the FBI was making lots of noise. By 2004, 2005, the FBI was pressing for extensions of the Communications Assistance for Law Enforcement Act to various kinds of VoIP and so on. I pulled together a committee of people to look at the technical risks, and I was fairly sure it

included Matt. I know it included Steve. We did that. Then a couple of years later, there was the Protect America Act. That was after *The New York Times* scoop about collection of communications content, some of it domestic, being collected without a FISA warrant.

I remember at the crypto meeting; I had pulled us into a room. It was Matt, Steve, probably Whit, Peter Neumann on the phone, to think about, “We need to respond. Where will we respond?” We ended up writing a paper for *IEEE Security & Privacy* on the privacy risks of the Protect America Act. I think Jen Rexford was part of that, too. By then, we had a pattern of doing these group projects.

Just from knowing the dynamics of how things work, we began writing law review papers together. We each bring different skills. We each get annoyed at each other for these different skills. I am a morning person. They are nighttime people, so there is finding a time to actually do our calls.

I have a good working relationship with them. I have been very busy while I have been at Tufts, and the last paper we did together was one with Brian Owsley a few years ago. My last email exchange with Steve was this morning when he read over something I wrote. My last conversation with Matt was 10 days ago when we were at a meeting, and I asked whether or not I should write the thing that I just sent to Steve to look at. I consider them among my closest colleagues and have really enjoyed and benefited from working with both of them.

Yost: Can you talk a bit about the Edward Snowden disclosures and whistleblowing?

Landau: There are many different stories, but I’ll start with arriving at the Privacy Legal Scholars Conference on the night of probably June 5th that year [2013].

Barbara Simons had sent me a *Guardian* article, and I looked at it. As I mentioned, I’m not great at night. It was nighttime in California, and I said, “Okay, I’m going to have to blog about this, but I’m going to do it in the morning because I should not stay up now.” I got up and at this meeting of the Privacy Legal Scholars Conference was Steve and Matt, and I think Ed Felten. Most of the Privacy Legal Scholars Conference at that time was lawyers, and there were just a handful of us [computer scientists]. I was sitting next to Steve at the first session. He had a call from *The New York Times*, and I had a call from NPR, and I really didn’t go to the

meeting at all. My husband was home, and he said my work line was ringing off the hook. I did a bunch of interviews. Steve did a bunch of interviews.

Man, it was crazy. I remember, at one point, somebody wanted to talk to me, and I said, "Why are we talking by phone? You're at the conference." She said, "because I haven't had time to change out of my pajamas, it's been so busy." That's that story. The story about the Snowden stuff, so I'm not sure exactly what question you're asking. Ask me some questions, and then I'll tell you various things.

Yost: I guess a very basic question is, did you see it as ethical disclosure on his part, to disclose?

Landau: It was a very useful set of disclosures. I think what Daniel Ellsberg did was quite ethical. There's no question for me that's well above the bar. I'm not sure I would have made the same set of decisions as Edward Snowden did. I think he did it from an ethical standpoint, but I'm not sure I would have disclosed as many things as he did. Some of them changed U.S. government policy in really important and useful ways, and it wouldn't have happened without those disclosures.

I have had a senior member of the U.S. government say to me that they thought the bulk metadata collection was perfectly okay, and nobody would object, and they were really quite surprised when they found out [that there were strong public objections]. That kind of wearing blinders is very unhealthy for a democracy. The fact that we have the IC on the Record, the information that the intelligence community puts out now, is extremely useful. None of that would have happened without it. I remember because I wrote a book that came out in 2011, so shortly before the FISA opinions [were made public by Snowden]. And I think there were three, maybe five FISA court opinions that had been public by that time [2011]. FISA intelligence, FISC opinions that had been out, that had been released by various people. Not legally released, that is, through the process and so on. Now, many more are out, and I think that is healthy. When you know the public is overseeing some of what you do, you think differently. You act differently.

Yost: Was it disclosures for many things that were already suspected that NSA was spying on US citizens?

Landau: Depends how paranoid you are. The disclosures about the bulk communications surveillance had been revealed by *USA Today* in 2005, and nobody picked up on it. It just got sort of ignored. I

think the answer is it depends how paranoid you are. At the same time, I have got to say here that I have been at a number of events where there's somebody from Germany or somebody from France on a panel, and they start declaiming against the U.S. for its collection that got revealed under Snowden. Then I raise my hand and I say, "Excuse me, but wasn't your government handing over stuff to the U.S., some of which got released?" They say, "Yes." I say, "You put me in this really weird position where I find myself defending the NSA." I think that part of the response to the Snowden disclosures has been a faithless ability to criticize the United States while [their countries were] doing the same thing themselves.

Yost: You testified before Congress with the Apple 2015 and 2016 case regarding the iPhone and encryption. Can you talk about your position and your testimony?

Landau: Sure. I'll talk about the testimony first, which is the committee had decided to hold a hearing on encryption. The Apple FBI story broke, and the hearing focus changed. My position was that in order to satisfy what the FBI wanted, Apple was going to have to do changes to its operating system, that were not going to only put the person whose phone was being opened at risk, but anybody's phone at risk. I think Apple had been defending itself on largely the basis of the All Writs Act and that it wasn't applicable.

In fact, there's a strong security argument to be made for not doing it. I know that they quoted some of my points in the brief that they submitted to the court in California.

I hadn't expected to be doing this testimony. I had a trip to New York with my husband planned, and we were down in New York, and we were cutting the trip short so that I could finish the testimony. When I realized it's an important issue, and it's one I have made repeatedly since then, is that the FBI was trying to investigate 21st-century crimes with 20th-century technology. It wanted the ability to do wiretaps even in the space of all new things that they could collect and all the new ways they could get at data and so on. We had to rush home so I could write that new section for the testimony.

It then became my next book, essentially, after the testimony. I had gotten enough invitations to speak and to do interviews that I decided it made sense to write a new book on. Whit and I had written a book on securing communications. Now, it was about securing devices and why securing devices was really important. I'm not sure what else you want to know. I think I have given you

two nutshells. Now, you can tell me what else about the nut you want to know.

Yost: That was pretty much what I was getting at. In your book, *Listening In*, you write about breaches against the Ukraine, Sony Pictures by North Korea. I wonder if you could speak about state-sponsored hacking capabilities and the challenges that that presents.

Landau: Sure. It depends on what point in time you look. By now, there's the U.S. and Russian capabilities. The UK is probably somewhere up there too. China is increasingly increasing in sophistication. Israel is quite sophisticated. North Korea and Iran [capabilities] are also increasing. North Korea is putting a certain amount of effort into cybercrime as a way to raise money since its economy is down the tubes. Those are the countries most involved in offensive capabilities.

There are both cyber exploits, the theft of data, and that's spying, which everybody agrees is illegal when you catch the spy in your country and perfectly legal when the spy is in somebody else's country spying for you. There are cyberexploits. As any computer scientist can figure out fairly quickly, that the difference between a cyberexploit and a cyberattack is that after you collect information, send it out, collect more information, send it out, keep doing that, if you do an attack, it's a cyberattack. If you don't do the attack, it's a cyberexploit. Telling the difference is pretty hard, especially when the attack code may be very short [and thus hard to find].

One of the things that makes all of this so very complicated is that these attacks go in the gray zone between actual conflict. How do you respond? It took us, the world, a long time to understand. You do not need to respond to a cyberattack with a cyberattack. You can respond in a different way entirely. It can be kinetic. You mentioned the Ukraine attack, and that's the one of 2015. The interesting thing about that is that there had been this theory that we were pretty immune from attacks on the power grid because there are all these different grids that are nested into a particular grid and getting them all down at once would be really hard. Then three different power distribution systems in Ukraine went down at once, that is, within a half hour of each other.

Clearly, the adversary, we now know had gone in a half year before, had poked around, gotten information, presumably experimented in a lab that they had, and then went back and launched the attack and probably continually downloaded data, but launched the attack in a way that three grids went down at once.

That was an eye-opening experience for the U.S. and probably other countries, too. The other interesting experience for the U.S. is that because the systems in Ukraine were relatively old, even though their machines got fried, there was physical backups that they could actually go by hand. Within a few hours, the Ukrainians had restored power. DHS got a lesson from that, which is a nice introduction to the point that I don't hear people using the word "security" anymore. We don't talk security; we talk resilience: being able to do the functions that you're supposed to do, that is, the absolutely necessary ones, and being able to maintain those even in the event of an attack.

Yost: You spoke about offensive cyber capabilities being thought of as a gray area, an area that people were trying to assess in terms of diplomacy and conflict. I'm wondering if you could comment on Stuxnet and whether that, obviously, a serious threat to peace, to have Iran developing deadly nuclear capabilities. That was something that caused a lot of damage and may have changed risk landscapes. I guess I'm asking, do you see a mistake?

Landau: Do I see it as a mistake or not? The answer is, when it first came out, I thought it was a real mistake. When I realized it got the Iranians the table to negotiate under the Obama administration, I thought, "Well, maybe it made sense." That's where I am on it.

Yost: Do you see it as changing how people perceive cyber warfare and the risks of cyber warfare escalating to military conflict?

Landau: If you look at the attacks on Ukraine, you see that cyber has not played a huge role there. There were attempts just at the beginning to take out communications. Some of that backfired on the Russians because, of course, when they took out physical infrastructure of 5G, all of a sudden, they couldn't use their encrypted communications. They were using unencrypted communications. The Ukrainians targeted them very well. If you're reliant on the other guy's infrastructure, be careful what you do.

The other thing that happened, of course, is that there were various changes that happened. One is that the Ukrainians moved their online government outside the country so that it was secure in a different place.

The fact is that while you can take out Starlight ahead, the Starlight satellite system or the communications, before a conflict starts, once you're trying to time kinetic warfare with cyber warfare, it's pretty hard. It's not as easy as science fiction would have it be is

the answer. It's going to be a support piece of cyber warfare. It's going to be a part of gray-zone conflict. Past that, I'm not enough of a military guy to tell you exactly, and if I knew all these pieces, I couldn't tell you how you would do it. I do have to say, and I'll just say one sentence and not more. Putin's willingness, almost enthusiasm in attacking civilian infrastructure and civilians, has probably changed the way that China thinks about actions regarding Taiwan. That will have implications for cyber.

Yost: What's your opinion on what was achieved with the GDPR? Are there things that you would like to see in privacy legislation that are not included in the GDPR?

Landau: I think we're in the early steps of the GDPR. One of the small things that I find quite interesting is that the Netherlands was able to put requirements on software telemetry of U.S. companies, software that was being sold to the Netherlands that required limiting the collection, informing users of the collection, and so on, and saying to the U.S. companies, "Look, you comply with this. We're a small market." Then you're complying with GDPR, which provides you with a big market.

I think that that's very interesting. Funny that you should ask about privacy because I have a paper coming out with a postdoc very shortly that talks about the use of communications, smartphone communications, metadata, and device and software telemetry. The fact that this is data the user can't control in the case of the metadata because the metadata has to come out with the communication. The user doesn't really understand in the case of the software device telemetry, what the import of the use of the data is.

There is an act that was in Congress last fall that had bipartisan support but didn't pass, and we're hoping to see it revised. I would add to it protections on telemetry and metadata, strong protections there because this is data that the user simply can't control the use of. I don't know the extent to which the GDPR is going to increasingly change the U.S. tech companies' hunger for and use of civilian data, but I expect that it will.

Yost: Can you tell me about your style and approach mentoring graduate students, how you engage students and advance their work in graduate education?

Landau: I haven't had many students, and I don't have any right now. Working in an interdisciplinary area is really hard because this is not a matter of learning algebra and theoretical computer science.

This is a matter of learning law and tech. That's really wide. I have worked with some postdocs, and then I say, "Well, here is the stuff. Here's the problem that's interesting, and here's the background you need to learn."

I have sought to do tech and work with students in tech-informed cybersecurity policy, but there aren't a lot of positions right in that niche, even though if you have tech-uninformed cybersecurity policy, you have uninformed cybersecurity policy. In conversations at the Hewlett Foundation with other researchers and faculty in cybersecurity policy, I'm not the only one who's found the students steer away from learning the things that are not straight in their area of social science or law. Although I have to say that last week, I co-organized a workshop, a four-day workshop in tech for social science and legal scholars, for graduate students, postdocs, and young faculty. That seem to go over very successfully. That's teaching them a little bit about operating systems, network protocols, how systems work, how networks work, cryptography, and having them do labs. That may give them a taste for what they need to learn, but it doesn't educate them at the same level as the question you're asking.

Yost: Can you tell me about the context to your writing the book *People Count*?

Landau: Sure, that's easy. I was on a civil-society call sometime in March. Somebody I know who's quite smart technically said he had been on a ferry, and later, he found out that person on the ferry had COVID. Now, that person was on the same island as him, and he wanted to know where that person was. While we didn't definitively know that the disease was spreading indoors and almost never outdoors, that understanding was pretty clear by that point—though not scientifically shown. I thought, "Well, that doesn't make any sense because GPS doesn't work indoors."

I wrote a blogpost for *Lawfare* just explaining the different technologies: what Bluetooth could tell you, what GPS could tell you, what Wi-Fi could tell you, and so on. Then I followed up with another *Lawfare* blogpost. I don't even remember a little bit more detail about some of those type of things. I had done a study with the Carnegie Endowment for International Peace on Cryptography. One of the participants in the study had said, "Whatever rules we come up with about what to expect companies to do or this or that, we need to make sure that the regulation does not have a discriminatory impact." That is, it's not done in a way that Apple could engineer something that's privacy protective but the Android

phones could not because it would be too expensive. I had never thought that way.

I thought, “Wow.” I thought about that idea a little as I’d written these two blogposts [about the technology that could measure how close two phones—and thus two people—were], and I wrote to two of the people who had been on the Carnegie Endowment study. I said, “I think I would like to write a thing about location tracking and impacts on minority communities.” We did a piece. By now, I had done three pieces. Then on a mailing list, I heard MIT wanted a short book on contact tracing apps. I thought, “Well, I have written three pieces. How long is a short book?”

I knew the computer scientists who were involved in building the various systems because they’re all cryptographers, and I know them since I was a kid, as it were. I have known some of them for 15 years because they’re only that long in the field. I talked to MIT Press, and we agreed I would do the book. I had to learn some of the biology and so on and the medical stuff and so on. I talked with contact tracers and behaved a little bit like a journalist, except I’m not trained as a journalist, but I tried over the years to learn some of those skills.

The part that was most interesting to me in the book or the part that was easy for me to write the stuff about how the technology works, the Google, Apple stuff, because that’s stuff that’s closely related to things I think about. The stuff that was more complicated to write about was about impacts on minority communities. I had to stretch myself there. In the blogposts we had written, we got asked to brief a group of civil liberties groups that were involved working with minority communities, so they would learn what their risks were. I then followed up and said, “Look, I want to talk to more of your people because I’m doing something a bit more extensive, and I want to understand what the issues are.” That, to me, was the most interesting part of writing that book for the stuff that I learned there. That’s how I ended up writing the book.

Yost:

In your incredibly distinguished career, you have won many awards. You won the Vision Award from the Anita Borg Institute. You were inducted in the National Cybersecurity Hall of Fame and ACM Fellow. What have these meant to you?

Landau:

I don’t know. I felt really flattered to become a national associate of the National Academies because that’s a place that it’s not an award in that sense. It’s an award about service as opposed to intellectual contribution because I have really given a lot but gained a tremendous amount in my National Academy service.

Working with such smart people and interesting people and largely very dedicated people because they're all volunteers, has been a really wonderful experience for me. I was very grateful for that, even though I have been down to Washington very little. I haven't availed myself of the ability to sit in the members room and have a cup of coffee. I have been very grateful for that and felt very pleased.

It's flattering. I was quite pleased about the books with Whit. I was pleased for when I won some awards for books on my own because when they weren't with Wit, they were mine.

[After the interview I found out that Steve Bellovin, Matt Blaze, and I were being awarded the USENIX Lifetime Achievement Award for our policy work; I was really thrilled. And then later in the summer, I learned that I would be receiving the 2024 Bertrand Russell Prize from the American Mathematical Society for my technical papers, op-eds, and policy work, including briefing policymakers, and I was thrilled all over again, especially as the math community had not been so welcoming of such efforts when I was a graduate student and young faculty member. It was wonderful to receive that award; I felt deeply honored by doing so.]

Yost: In terms of the Vision Award for Anita Borg, I mentioned ResearchHers and asked you about that. You also did a project for a bibliography of women's work in computer science. Can you talk about your decision to do that and that project and tell me a bit about that?

Landau: I don't even remember what prompted that. The world has changed so dramatically for women in, I would say 50, but it's more than that, in the number of years that I have worked in this area, since I was in middle school, high school. Certainly, in the 2000s, we were being ignored big time. We're still being ignored, but then we were being ignored big time. This was a way of highlighting us more. Over time, doing the bibliography took more and more time, and it was less and less clear that it was useful, so I stopped.

The thing that I'm actually prouder of for women is the work that I did with Hilarie Orman and Terry Benzel on GREPSEC. We had been at a meeting of *IEEE Security & Privacy*, the conference. The following year's program committee was announced, and there were 40 men and 2 women. We looked at each other, and our jaws dropped. I said, "Wait a minute. CRAW has money for discipline-specific workshops. Let me look at when the date is due," and it was due in a month. I said, "I could write a proposal for that."

If we got it, we'd get \$15,000. We all agreed that we were likely to also get money from NSF to do this. This was in May. By the end of the summer, we hit \$67,000 for doing this workshop, which we ran four times [in 2013, 2015, 2017, and 2019]. Now, it's been taken over by Michelle Mazurek.

I think our most pleasing times was we ran the workshop before the *IEEE Security & Privacy* conference. Our meeting would start Saturday morning and end Sunday midday, and then the IEEE meeting would happen. We noticed that instead of the women graduate students standing back at the IEEE opening reception, and they were chatting away at the refreshment table, grabbing things, talking to each other, because they knew people; they knew each other. That gave them enough confidence to start talking to other people, and watching that, Hilarie, Terry, and I felt terrific. There is where I put my pennies more recently.

Yost: In addition to your incredible and impactful scholarship, you have also taken the time to write on privacy issues for a lot of popular publications, *The Washington Post*, the *Chicago Tribune*, *Scientific American*, *Christian Science Monitor*, and appeared on NPR a lot. Can you talk about that role and the importance you see in communicating with broader audiences?

Landau: I was always, as I mentioned, interested in science journalism from a very young age. I was a reader of *The New York Times* when I was quite young and always thought I wanted to be a science journalist among many things. That was one thing I wanted to do. Also, the impact of Rotblat and the role he saw in informing the public about issues, which is why I, for example, shifted from writing for *IEEE Security & Privacy* on the magazine on cybersecurity policy issues to writing for law reviews, because that was the audience I needed to reach. I think informing the public is extremely important, and therefore, I do it to the best of my ability within the fact that there are only 27 hours a day or whatever number it is this week.

Yost: Speaking of law reviews, was it challenging for you, Steve, and Matt to kind of break into and gain the respect of law scholars and publishing these law journals?

Landau: First of all, you don't have to gain the respect of law scholars. You have to get the acceptance by third year law students, which is the challenge.

Yost: Right, students, law scholars in training.

Landau: Well, there are various oddities. In science and engineering, you send your paper to one journal or one conference. If it's rejected, then you're allowed to send it somewhere else. In law reviews, you send it to 20 or 30 places, and then you do this bidding procedure if it gets accepted. That part is crazy to all of us [scientists] and feels like, to me, a waste of people's time. The next part is the law students want you to define everything. I won't name the journal, but at one point I got a weird request. The law review asked me, "You say something occurs so many times a millisecond and so many times a day. Could you explain?" I said, "A thousand milliseconds in a second, 60 seconds in a minute, 60 minutes in an hour, 24 hours in a day. If you make us put this in a footnote, we will be mortified." They didn't. I think by the time that I wrote my first law review piece, I had read enough law review pieces to have picked up the lingo.

What I do find that's hard is if I write a law review piece, I tend to go on a little too much when I then write a scientific piece because in a law review piece, "Oh, there's this thing over here. It's distantly related. I got to cover it." In a scientific piece, you just drill down to the topic itself. Going between the two [fields] is complicated.

Yost: Before we conclude, are there any topics or themes I haven't brought up that you'd like to talk about?

Landau: You have asked me about women. You have asked me about Rotblat. You haven't asked me about my developing the Master in Cybersecurity and Public Policy at Tufts or about teaching in general. Let me talk about teaching and then about the program. I have learned my teaching, as I have said, from teaching at the NSF Math Program at Hampshire College, Hampshire College summer studies in mathematics. The director there is an amazing, amazing teacher.

I have learned a lot from teaching, from observing him, and also from the way he developed the program. That was mathematics. We would meet 6 days a week for 4 hours each morning and 5 nights a week for a problem session for 3 hours in a group problem session. I had wonderful students, really smart students. Many of them have gone on to get PhDs in math, some in computer science, some in other fields. That taught me a lot about teaching. It taught me to stand back and ask a question and wait a long time for the answer, to give the students room to calculate, to not to teach them, but to lead them, so not to tell them theorems, but have them guess theorems, which is unusual in a college class, do some computation, and so on. I have done that when I teach discrete

math at university. As I switched fields, of course, what I teach changes, but I still ask a lot of leading questions.

Then when I got to Tufts, I thought I was being hired as a Bridge Professor to do research and teaching. Literally, my first morning there at 9:00 a.m., the Dean of Fletcher called me in and said, “When are you going to start the Masters Degree in Cybersecurity and Public Policy?” I didn’t think I was being hired for that. I wasn’t smart enough to say, “Well, wait. How else are my responsibilities changing?” I did start that.

We’ve had the degree program going for three years. It’s a complicated degree program because we take students in with a policy background of International Relations or Law or Economics or Political Science or a background of Computer Science or maybe IT. We give them three tech courses that are specially designed, except the computer scientists don’t take that because they know that material and then three policy courses.

One is a privacy course, one is an international cyber conflict course, and then one is a choice between cyber and the civil sector or cyber law and cyber policy. Then they have some electives from either school. What we try to do, we can’t make them experts on either side. What we try to do is grow translators, which I think is increasingly important. I’m pleased to have developed this program, although it’s also complicated to get two schools that have never worked together to work before, and I can’t say that that part is a complete success yet.

Yost: What types of positions have the graduates taken?

Landau: I should dig up my latest compilation of that. One of them was working at a military base doing cyber, one of them is working for a consulting firm that’s consulting for DHS. One of them, the last I heard, was in the National Governors Association doing cyber. One of them, I think, is now working for some version of naval office. They’re all doing a variety of things. I have a list somewhere, but I don’t remember all of them.

Yost: Anything else?

Landau: Not that I can think of. I have been going a long time now.

Yost: Yes. Well, I greatly appreciate your generosity with your time and your insights.

Landau: You were really generous. You have spent a lot of time reading, studying vitas, and doing all that stuff. Steve couldn't have told you everything about me because he only knows some parts.

Yost: No, this is really enjoyable. We did a project at CBI. I did it with Tom Misa from 2012 to 2015 for NSF on computer security. Then with this project, it's on both security and privacy, but we're trying to focus more on privacy. I have become especially interested in privacy and issues of surveillance and inequality in the past few years. We've had some major symposia here like "Just Code" and "Automation by Design." So. this is really fascinating to me.

Landau: Cool.

Yost: Okay. Well, thank you so much. Probably in a month or so, I'll have a transcript for you.

Landau: Okay, sounds good. Okay, thank you.

Yost: Take care. Bye.

Landau: Bye.