

Interviews of the Margaret MacVicar Memorial AMITA Oral History Project, MC 356

Massachusetts Institute of Technology, Institute Archives and Special Collections

Ruth Nelson – class of 1963

Interviewed by Natasha Balwit, class of 2016

July 15, 2013

Margaret MacVicar Memorial AMITA Oral History Project

Ruth Nelson (SB Mathematics '62) was interviewed on July 15, 2013 by Natasha Balwit (SB Urban Studies and Planning '16) at the S&S Restaurant in Inman Square, Cambridge. Nelson – a network security and communications expert who, in 1959, was invited to the White House as a finalist in the Westinghouse Science Talent Search – is a former systems engineer at BBN Technologies and at GTE Government Systems. She is currently a photographer, collage artist and meditation coach.

BALWIT: How did you get to MIT?

NELSON: It's a funny story. It's one that I tell a lot. MIT is different from most other top universities, still. It has a rather high percentage of kids who are the first in their families to go to college. It's still much more diverse than most of the other top schools – majorly more diverse.

I grew up in Philadelphia. My father was a pharmacist and my mother helped him and did lots of volunteer work, especially with the Girl Scouts. I was quite good in math and science in high school. We didn't know about MIT. Everybody in my family who went to college (and it was mostly the guys; women didn't necessarily go to college in my family) had pretty much gone locally – to Penn, or Temple, or the Philadelphia College of Pharmacy, which is where my father went.

One day my mother and I were reading the college handbook, which listed schools, and we got to MIT. We saw that the class had 900 guys and 21 or so women. My mother said, "Oh, good!" She was despairing that I wouldn't find a guy, because I was too smart in math. This was the fifties.

Another thing we learned about MIT was that you didn't have to live on campus after the first year. That was because there weren't any women's residences, just 120 Bay State Road for the freshmen and a few slots in Bexley Hall [one of the firms MIT dorms to become coed, demolished in 2015] for the upperclass women. I said that was good. And they didn't have a gym requirement for women, because they didn't offer anything, and *that* was good.

So I applied to MIT, as well as University of Pennsylvania and Bryn Mawr. My high school counselors were against it – only one girl from the Philadelphia High School for Girls had gone to MIT and that was in the 1930s. Lots of Girls' High girls went to Penn and Bryn Mawr. And Penn had the Mayor's Scholarships for

full tuition, given to the top students from Philadelphia, which I had an excellent chance of winning.

I was taking trigonometry in high school, and I hated the calculations. At that point they had logarithm tables, and when we were solving and using numbers for angles and things, I never got the right answer. I was just hopeless at this kind of thing – looking up things in tables and doing simple arithmetic. But I totally adored solving trigonometric identities. I actually wrote to MIT Math Department and I asked them how important these other things were compared to the identities. They said the identities, and understanding identities and the nature of trigonometry, were more important. That encouraged me towards MIT.

After I visited Bryn Mawr, I withdrew my application. Bryn Mawr was much girlier than my high school, with hoop rolling at graduation and things like that. I didn't think I could get a good math education in that environment. The Girls' High teachers and counselors were disappointed, but I still had MIT and Penn, and then I got into MIT after early admission. That's where I ended up going.

I graduated from high school in January, so between January and September I worked in the mail room at a General Electric sales office. I had a man's job, as I taking the place of someone who was on active duty in the reserves for six months. I was making much more than my friends. At that time the help wanted ads were male and female – separate. The minimum wage was \$1 an hour, which was what most of my high school classmate girls were getting. I was getting \$1.50 an hour.

I took advantage of the time to learn calculus. First I thought the engineers at the office could help, but they really couldn't, and so I worked my way through Thomas' Calculus and ended up getting two semesters' worth of advanced placement. Math was easy and fun for me. My science teacher in high school told me, "Go into math, not science." I think he was right. I just have the mind of a mathematician, not so much a scientist.

BALWIT: You sound like you were really smart in math in high school. Were you really studious? Did your family encourage that?

NELSON: I grew up in a Jewish household, a slightly non-traditional one. Jewish households kind of fostered "You gotta learn," "You gotta go to college" – all this kind of stuff. Mine did it for me, too, as well as my brothers. I was the oldest.

I just had a lot of aptitude. I could do school work pretty easily, and I could also do it in a noisy environment. I had two brothers who are younger. The TV would

be on and I would be studying, because I could. I got lots of prizes in high school. And the neighborhood newspaper would come to interview me and take a picture of my desk. We would phony it! We took the piano bench, stacked books on it and put it next to a chair. This was not how it really was, but it looked better.

I really did very well and took tests like crazy. Our high school actually tested tests for the Educational Testing Service. So we had some pretty bizarre tests, both in content and in how you chose your answers. There were even paper 'flaps' in some of them that you had to open for clues.

In 1959, when I graduated from high school, I was a finalist in the Westinghouse Science Talent Search, now the Intel Science Talent Search. [As of 2016, the Regeneron Science Talent Search.] That was a real turning point in my life, because I got to go to Washington with the other 39 winners. It was 10 girls and 30 boys. I had not been in that kind of environment before. I had a fabulous time. They took us to different places to see labs (even room-filling computers) and meet scientists. We even had our photo taken with President Eisenhower.

At night we kids went out cavorting. We went to the Lincoln memorial at midnight, after getting pancakes. We would have been arrested today, but at that time they just chased us away. Being in that environment was so intense, so wonderful. And it was fabulous, being with all those guys who liked science and math! It just cemented my conviction that MIT would be a good place to go. We presented our stuff to the public in an evening thing. My project was about teaching set theory to kids, and this was way before they did the New Math in schools.

BALWIT: What kind of theory?

NELSON: Set theory. Now it's standard, but then it wasn't. One of my teachers had gone to an advanced summer workshop that included infinite set theory. I finished geometry early, so she let me play with her workshop book and helped me with set theory. I fell in love.

Structurally, set theory is so simple-- It loses all the other structures, except things get clumped together, and that was it: no operations, except unions and intersections to determine inclusion in the set.

The Science Talent Search had its own test at that time (later they used the SATs). It was a really hard and fun test, designed so that no one could get anywhere near a perfect score on it. I did quite well. We also had to do a small paper, describing our project. Now the kids do serious research projects, often

working in an academic or commercial lab. It was less project-oriented than it is now.

BALWIT: When you got to MIT, did it live up to your expectations? Was it adventurous?

NELSON: It was. A bunch of us women lived at 120 Bay State Road, across the river, in Boston. It was fabulous. I was just at my 50th reunion.

There were four of us in my class of women at MIT who were Betty Crocker Homemakers of Tomorrow [a scholarship program launched by the company in 1955]. I was a school winner, but two of them were state winners. They were both at our reunion this week. The Betty Crocker test included a lot of household math like converting recipes for more or fewer people. Not surprising that MIT women did well on it.

When I came to MIT, I had done enough of the calculus and gotten advanced placement out of it, so I started off with 18.03 at that time-- And what else? I took a linear algebra course. It was so exciting! It was really exciting.

Second semester, I had-- This is another funny MIT 'girl story.' I really disliked labs a lot. One of the guys I was hanging around with was another Philadelphian and an upperclassman. He suggested that I talk my way out of the second semester of chemistry and then take the advanced placement exam over the summer and get out of it. I thought that was a fine idea. I don't think he had done that, he just thought I should.

And then I studied the chemistry book over the summer and passed it. And the reason this is a funny MIT 'girl story' is that two years after I entered, my friend Harriet [Harriet Fell, SB Mathematics '64, Ph.D. Mathematics '69] came to MIT. She thought [testing out of chemistry] was a really good idea, but then she didn't pass the test, and ended up taking the chemistry class. She is a professor of computer science at Northeastern and is a really good mathematician [Harriet is now retired].

Since I didn't have to take 5.02, I started taking linguistics classes with Chomsky [Noam Chomsky, currently Institute Professor & Professor of Linguistics emeritus], second semester freshman year. It was incredibly exciting. New, hard, mathematical and about people too. Chomsky got me into an NSF Summer Institute in linguistics at University of Pennsylvania (we're both Philadelphians) that year. I was totally out of my depth (a lot of the students became famous later), but again, lots of fun. I took several more courses with Chomsky and some with Hilary Putnam [Harvard professor of the philosophy of mathematics].

I love that MIT was and is so interdisciplinary and lets students get involved in new fields, even when they're freshmen. It certainly changed my life! My daughter Diane is a linguist; she did her dissertation at the University of Edinburgh on Finnish syntax. She's now a Senior Lecturer at Leeds University. [In May 2017, Diane spoke with Chomsky at a linguistics workshop in Reading, England. He remembered me and told her that she was pursuing an appropriate career for an MIT daughter.]

Both the social life and the intellectual life were stunning. And there were all these people that I could have amazing talks with about everything. Norbert Wiener [Professor of Mathematics, recipient of the National Medal of Science and originator of cybernetics] was still alive. I don't know if you know of him?

BALWIT: I've heard of him.

NELSON: He was really old and famous. In high school, he was one of my heroes – I was fascinated with cybernetics. He was this old guy who was roundish, and had incredibly thick glasses, and was famous for just going down halls with a hand on the wall so he didn't have to look. I wandered into his office and said hello. I could never have done that at other places. I got to get involved in so many interesting, very new things.

I met my eventual husband freshman weekend. He was a classmate. I dated all of his roommates and apartment mates before I dated him!

BALWIT: So you got to know him through them?

NELSON: Well, I liked them all.

Gordy [Gordon Nelson, S.B. Biology/Life Sciences '64], who became my husband, was a biologist and he was working with Jerry Lettvin [Jerome Lettvin, MIT Professor of Electrical and Bioengineering and Communications Physiology]. He was Jerry's student. He did his thesis with Jerry eventually. So I took some biology, and I worked in Jerry's lab the summer after I graduated, doing microsurgery on tadpoles. There weren't any boundaries. There weren't any limits.

BALWIT: What was it like socially?

NELSON: I was very active in Dramashop and in Tech Engineering News, which was an engineering magazine. It was very heavily supported by industrial advertisers. We were talking about that at the reunion, too, because a bunch of us women were involved in it. We would go to press about once a month, and then everybody would get treated to a really nice dinner. And most weekends, if I didn't have at least three dates, I thought something was wrong!

BALWIT: What was it like? What were the dates like?

NELSON: Simple: movies or food. I had one boyfriend freshman year who was rich: he had a car. The family business is refrigerated shipping. I ran into him years later; he came up and visited with his family. He was engaged to a girl in Florida, but he and I were friends and went out. A lot of dancing – he was a great dancer.

BALWIT: What music did you have?

NELSON: At that time? Couples dancing and some jitterbug-ish stuff.

BALWIT: Sounds great! Would they just call you and ask if you wanted to go out this weekend? It sounds fun to me.

NELSON: That whole dating scene has changed so much. Some of it was more formal and some of it was just get-togethers and parties. I mean, there were so few of us girls, so even though most of the boys didn't have anything to do with us, there were still enough that did. We got invited to a lot of parties – you know, frat parties and whatnot. I learned really quickly freshman year to estimate the amount of alcohol in a drink because it was often lab alcohol and grape juice, which could kill you. There was a Dramashop party – the cast parties were incredible. You had people actually passed out in the bathtub.

There was one Dramashop party where Gus Solomons [Gus Solomons, Jr., a dancer and choreographer], who was a famous Cambridge guy, MIT student – he was also a fabulous actor and dancer, a stage dancer. At one party, in the winter, we were dancing down the middle of Mass Ave. at two in the morning. It was so good.

BALWIT: You have so many exciting stories!

NELSON: At the end of freshman year, I got mono. I was really sick. My boyfriend was driving me to get frappes, because it was the only thing that would help. My mouth was so sore! It was just around finals, and I obviously couldn't work that summer. But Chomsky got me into a summer institute at Penn that was run by some of his professors and fellow students there. I wish I had the list of people there, because the density of people who became famous linguists was really high. I had no clue what I was doing. I tried really hard to understand what they were doing, and had a great time.

BALWIT: So you went there even though--

NELSON: By that time, I was semi-convalescent and was living at home with my family.

The opportunities— That, and working in Jerry's lab and working in artificial intelligence, when it was really new.

I had a summer job at Project MAC [MIT Project on Mathematics and Computation] working on a LISP program [LISt Processing language, the second-oldest of high-level processing languages, FORTRAN being the oldest] to solve mathematical equations with symbolic manipulation rather than numerical approximations. That was really way ahead of what was happening with computers everywhere else.

BALWIT: What was your major?

NELSON: I was a math major, pure math. No labs and flexible requirements. I ended up graduating in three years, through some advanced placement. Also, I wanted to get married. Gordy was a classmate, but he was in biology, and had much more lab work. He ended up graduating in five years.

Even though I had a General Motors scholarship for a little bit more than tuition, my parents really couldn't afford anything. So by graduating and getting into MIT graduate school, I got an assistantship that paid – I think it was \$150 a month or something, but it was better than paying tuition.

In retrospect, it was a bad choice to graduate. I was twenty, and I was facing a math department full of sexist pigs – and I didn't understand the social process of graduate school. So the difference between undergraduate and graduate in some respects, was in social mores, although I had seen some of it in undergraduate.

When you have objective tests and whatnot, and regular classes, the sexism doesn't show up as much. But I took a senior seminar in math, and the professor hated me. When I tried to give a talk and open my mouth, he wouldn't let me say anything. He jumped all over me, and of course that made it worse, and I got worse, and I couldn't give any more talks because I just couldn't handle it. He gave me a C in the senior seminar. I had been routinely getting A's in everything. I was totally shocked and crushed because I assumed that I was really as bad as he was acting as though I was. There was very little support telling me, "No, he's a sexist pig." People didn't know 'sexist pig' in 1962.

In spite of him, I got admitted to MIT grad school [also in Mathematics]. And again, the classes were fine. We had study groups, problem set groups with the guys. They were terrific. I was having again a fabulous time, learning all kinds of new things and getting excited, although it was different being married, because Gordy wasn't all that supportive, but it was still great.

I was taking these other distribution subjects, and I took my language exams and all this kind of stuff. I didn't even have to even take any qualifying exams. MIT's Math Department did not give out a master's degree after you were there a year – Harvard did – you just went straight through. So I finished all the coursework, in, I think, about two years, and wanted to do a thesis in geometry of manifolds.

The professor was a nice guy, but quite reserved. And as I said, I didn't understand the social process. I didn't know that you really had to learn how to play bridge and be in the common room, hanging out with these guys all the time to get any attention from them. It probably wouldn't have worked, but I should have at least been aware of the process.

And there was no coaching for how you do graduate school. So when I stopped taking coursework, I basically couldn't do anything. I was afraid to ask for time from the professor. I was trying to just read and understand and do the stuff on my own. The idea was that you should find your own thesis project, which there was no way I was capable of doing at that point. There was no "Read this, read this." He did give me a couple of papers to read, then we discussed them, discussed where they were going, and then I couldn't get to see him again.

Three years in, they put in a five-year limit. They never had a time limit for Ph.Ds. I don't think they have one now, but they were at that time trying to be the best math department in the world – MIT being competitive.

I found out much later one of the ways that they tried to do this. The year before I entered, they brought in Nash [John Forbes Nash, Jr.], the guy in "A Beautiful Mind," as a CLE math instructor. He was supposed to be one of their bright lights and help them get to be the best in the world. Then, the spring before I entered was when he had his breakdown and ended up in McLean Hospital. When I read the book, there were all my math professors being completely stunned. Their world view was shaken up by the fact that you could be a brilliant guy and crazy at the same time, and not be able to do anything, and I don't think they recovered from that, because it was such a jolt. So they kind of redoubled their efforts to be the best in the world.

Anyway, they put in this limit. At the end of four years, actually, six weeks before the end of the term, I got a letter from the head of the [Math] department. It was about two sentences long, kicking me out and saying, "If you can do a master's thesis in six weeks in a field that you haven't done anything in, then we'll give you that – but you're out." I kept the letter just in case I ever think they were reasonable.

BALWIT: And what did you do?

NELSON: Well, Gordy and Jerry had been working at this fabulous interdisciplinary place, Scientific Engineering Institute, in Waltham on [Route] 128. I got a job there, and it was amazing. I was working with really interesting people.

One thing that had bothered me about pure math was that you don't see the usefulness of it until much later – somebody else notices that and uses it. It's not about usefulness, but I always wanted both. So it was useful, it was aesthetic, it was with people. I got positive feedback and I got money. So I climbed out of the depression I was in quite quickly. That was the beginning of my career.

BALWIT: And have you done this ever since?

NELSON: No, of course not. This was still 1966 when I got kicked out of MIT. While I was at SEI, I worked on some data communications projects, which I loved, as well as a neat project taking medical histories from people and producing reports in pretty good English for the doctors. I learned about computers and really how the hardware and the software worked. We had a unique, experimental computer, and I even got to write microcode, way before it became a common thing. Mostly, it was government-funded research, some very secret.

But then I got pregnant, eventually, in '68. So I had to stop working at seven months, because they decided it was a factory, even though I wasn't working near any labs, and the law said you couldn't be in a factory after that. Gordy was still in graduate school, trying to do a thesis with Jerry Lettvin and, again, not getting anywhere – after Diane was born.

I was supporting the family, so I went back to work part-time, because I had an infant. They took me back part-time, but the way they calculated my salary was to just take the hourly rate and divide it, with no benefits. I was working three or four hours at a time, so there was no way. I did that for a little while, but then I switched part-time jobs.

I found a job part-time at one and a half times what I was making, which was still nothing, but at least it was better than nothing. It was in Harvard Square, for a little startup, where the boss had to go to the bank every week to get another advance to make payroll. I worked there for a while. He specialized in hiring non-citizens, because he was doing data-reduction work for Hanscom Air Force Base and he could pay them less; they were so limited and couldn't get the clearance that they would have needed to get more money.

I actually liked working there because it was right in Harvard Square. I got Gordy a job there. Of course, he was full-time. That lasted for a while. It was very good,

because he was actually making some money and helping support us. He'd gotten fired from his previous job already.

And then I got pregnant again. Right after my son was born, Gordy and I were working on the project jointly. He was trying to get the hardware installed at the site in St. Louis, and I was trying to do some software. They also had a consultant who was doing other software. I was working primarily by phone from Philadelphia, from my parents' house, and Gordy was on the computer, because he could only get time in the middle of the night. That went on for a while. It wasn't working. I found bugs in the other guy's software.

Anyway, I finally got home in March, thinking I could handle this myself with the two kids and be a housewife. And then we had a house fire. Gordy was in St. Louis. I asked him to meet us at the hotel. Thank goodness the kids were in daycare. So that was it. A few really crazy months.

Gordy was still in St. Louis and I was still trying to work by long-distance. My boss, who was still trying to make it on the shoestring, was telling me that I was an interfering wife for wanting to him to come home for Easter in the temporary house that we had rented by then.

Then the project collapsed, and it turned out the hardware was just not compatible. Gordy decided he was entitled to some time off, but didn't bother asking the boss. He just took off and went to a conference at Boston College, so they fired him. And then, because I was his wife, they had to fire me. So we had a house that was being repaired, living on the insurance and unemployment.

By that time, Gordy was a radio listener, which is crazier than being a ham, because they don't even talk, they just listen to really far away stations. He designed antennas and put together amazing equipment and things for that. That was his hobby. So he was busy trying to re-put together all of his radio equipment, which had been severely burned, and I was trying to raise two kids and supervise the rest of the house construction, which was huge. And he showed no signs of getting a job, and our unemployment was running out.

That was when I went back to work full-time, because I couldn't find a part-time job. David was one and Diane was four, and I went to work for GTE for the first time. I ended up with most of the rest of my career there, but with some breaks.

I was doing programming, and then I was doing systems engineering, for some very nifty things. I was doing a communications system at GTE, and it was a competitive thing, where two companies were building a prototype of a tactical telephone and messaging system, the TTC-39. I was working on the data communications, which was interesting and fun. After the prototype was done, I

worked on a computer-assisted instruction program for the Army while we were waiting to hear who won. We did – it was a huge contract! This was 1974, so things had improved for women, but not that much.

All the guys that had come in with me at my level were given groups to run. And I was assigned to work for this woman, who had been there for 25 years, was very senior and famous for not being able to be a manager. She was difficult. I was below the level of everybody I had come in with. I went to my boss and I said, "What's going on?" And he said, "I thought you didn't want to take that much responsibility, with your kids." He had married a woman who had been a single mom and had been very happy to retire when she got married to this guy who was making good money, so he just projected it on me. The assumptions!

That was when I went to work for DEC [Digital Equipment Corporation]. I went out for an interview in the morning and they told me they wanted to hire me at 1:30 in the afternoon. I got the job offer the same day I was there for the interview for this crazy project. It was a project that was way behind schedule, was critical to the delivery of a new machine, had been funded for three people, had gotten down to one person, the project leader, and they found me. Again, it was exciting, it was interesting, and it was crazy – a front end for the main processing system. My project leader couldn't make decisions – even where to go to eat dinner! But he was also being driven in six different ways by six different DEC vice presidents, who each wanted the system to do different things.

Four months after I got there, they fired him. I have many friends who worked for DEC, and they say they never fired anyone. But I saw them escort this guy out of the meeting and out of the building, and tell him he couldn't come back. His wife was working in the same building. Meanwhile, they had changed our supervisors three times in the four months before they fired him. I organized the going away party, off-site, and made our bosses come.

Meanwhile, I called the headhunter who had gotten me the job at DEC and I said, "You got me in, get me out." It took another four months, but I ended up back at GTE, in a different division. Now the first time around, where they assumed that since I was a mother, if I took any time off for being sick, for example, they assumed it was because of my kids. At that time, you could be a woman engineer if you were married without kids – that might be OK. But there were no working engineering mothers in the organization.

BALWIT: Oh!

NELSON: While I was working there, they put in long-term disability insurance for the first time – in 1973 or 1974. It didn't take effect until you were disabled for six months, and it excluded, of course, anything that occurred during committing a crime, or acts of war, or pregnancy, miscarriage or abortion.

BALWIT: What?

NELSON: They could do that then. The laws allowed it, so they did it. Another MIT woman who also worked there and I objected to this, and we circulated a petition to cover the pregnancy-related problems. We got in trouble with HR because of the petition, and we also wrote our complaint to GTE headquarters at Stanford. We got this absolute garbage answer, that there were all these telephone operators who were all getting pregnant and being disabled for six months by pregnancy. GTE was a phone company and they couldn't possibly afford it, they said.

The head of HR for our group of divisions was a woman, an old-style queen bee. She had her flunky, who ran HR for our division. The two of them accosted me in the lunchroom and said, "Well, we would take care of you if something happened." And I said, "Isn't it better for the insurance company to do this?" I just thought that list was an insult, and so did my co-worker Barbara. I mean it was insane. So I left fairly soon after that.

They tried to block my being rehired, because I was a 'troublemaker.' I was applying to the other division, the one that Barbara was in, and there was inter-divisional rivalry, so they hired me.

BALWIT: Oh, wow! Wonderful!

NELSON: These stories just happen. I went back there and then I stayed there for quite a long time. Then they were cutting back. I wasn't in danger of being laid off, but I was told to lay off some software guys. I thought that this was crazy, crazy business. So I went to BBN [BBN Technologies in Cambridge]. At GTE, I had caught the beginning of packet networks, including local area networks [LANs], and of computer security. And at BBN I got into the internet. Really lovely. Beautiful and new.

I was at BBN for a few years and learned a lot. Then I went back to GTE, and stayed there until they offered early retirement 20 years ago. I assumed I would go back after a year (staying away was a requirement of the offer), but I never did. Instead, I did a little consulting, traveled, did some heavy-duty meditation (including long retreats), developed my interest and ability in photography, and did a bunch of other things.

I got to do some good stuff in my career. But nothing has my name on it, which I'm convinced is because I'm a woman. I chaired groups. I wrote papers. I think I may have-- I'm pretty sure that I invented the concept of the firewall in computing systems. I have also had many experiences with groups of guys where I say things and nobody hears it, and then an hour or a day or a year later a guy says it and then they hear it. Some of that has happened recently – it's ongoing.

I think my favorite project was a series of research projects on architecture and protocols for Internet security. We (my team at GTE) really changed what security meant for the Internet and what mechanisms should be where in order to make it more secure. Some of the guys I worked with have told me that IPv6 [internet protocol version 6], the communications protocol that provides an identification and location system for computers on networks and routes traffic across the Internet really is mine.

We also did work on network security and vulnerabilities, including denial of service attacks, long before more powerful computers and faster communications made them possible. We knew them as a theoretical construct, but would anybody do them? Now these attacks are happening – and they're really hard to defend against.

BALWIT: It's really hard. There weren't that many women working in your field, were there?

NELSON: Mostly all my working has been ahead of the curve, and almost everybody I worked with is male. It's still happening. There are more women now, but the field still has a lot of both sexism and anti-social values.

There was an event in the internet world that shocked me – the Morris worm [distributed via the internet on November 2, 1988.]. Bob Morris, Jr., let loose a worm into the internet. He was a graduate student at Cornell at the time. His father was in charge of the computer security center at the National Security Agency. I was doing some research for them, so I was invited to some meetings to discuss the worm.

These discussions shocked me. The attitude of many of the guys was that Morris wasn't ethically or morally wrong to loose the worm-- The whole attitude of these guys was, you can get away with things if you're smart and that's what's important. It wasn't a good attitude. They were dismissive of him, not because he caused problems, but because he used well-known attacks and it wasn't original and creative.

BALWIT: Wow.

NELSON: That's still the attitude. It's [Edward] Snowden: "I can do it. And everybody else is stupid and only I understand." But that taught me an important lesson, because these were guys who were working in the security field for respected agencies and companies, and they were confused about what it was to be like a grown-up and a responsible citizen. I was shocked at it.

I think that a lot of what needs to happen in the internet, besides enforcement, is a change in the culture. A change in the culture of the country is unfortunately necessary, so that sharing becomes a good thing. You know, kindergarten kids get taught that!

BALWIT: Yeah.

NELSON: I think our country needs to learn it. It's still happening.

BALWIT: Do you think that there's much of that in MIT culture?

NELSON: I was so thrilled when I went to the reunion. The president of the senior class was a woman.

The president of the Graduate Student Council, and President [Rafael] Reif, the people who spoke at the other events – they all had a real understanding that the appropriate way to be smart is to use it to benefit the world. There was such a sense of that focus that I felt much better. I had been very down about the lack of that caring. I really felt it at MIT.

You know, I have been following somewhat the popularity of the things like the simple technologies that work for third world countries and poor places in the U.S. It's fabulous. It's just so right, and not about how cool can I be. Solar cooking, for example. I've seen what it does, and what it can do. And there seems to be so much more of that [at MIT], rather than [developing] the next feature on the iPhone.

BALWIT: Rather than how cool can it be, how helpful it can be--

NELSON: I keep thinking, with the money, the greed-- There was a film years and years and years ago; my mother used to love it. About wheeler-dealers, oilmen. There was some discussion in it about money. And the guy said, "It's not actually about having the money, that's just how we keep score." Keeping score by money, and keeping score by 'cool' is gross.

I was very touched at the reunion by the memorials to Sean Collier [the MIT police officer killed on the day of the Boston Marathon bombings, April 15, 2013].

One of the things I see a lot in my life is the support people being ignored. You know, if you're not the genius, forget it. Secretaries – all the people who make the place work – just being dismissed because they're not the geniuses. And that generally includes all the women.

BALWIT: I agree.

NELSON: How much of that do you see, as a freshman?

BALWIT: I haven't been around long. But I do see that nobody at MIT really questions whether you're smart. It's so nice. Even if you fail a test, no one will say that it's because you're dumb. People assume that you're smart. If you do fail a test, they might assume that you're better at something else.

In the circles I've been in, there's real respect for everybody. You don't have to earn it: you just get it by being here. People aren't listing their high school accomplishments and saying, "I deserve to be here more than you." I think that everybody feels inadequate compared to the others.

NELSON: You know, when I was at MIT, the number of women was so small because they only admitted as many as would fit into 120 Bay Street Road [the all-women's freshman dorm]. And then Mrs. McCormick [philanthropist, suffragist and biologist Katherine Dexter McCormick, '04] donated the money for McCormick Hall and cemented the place of women at MIT.

The faculty had actually voted in the early 50s again, before I came, to not have women there any more – after there being almost 100 years of women – because MIT couldn't be *in loco parentis*.

Some of the women and some of the administration got together, and Mrs. McCormick gave the money. That was the biggest gift they had gotten at that time. It cemented the place for women.

Eventually, MIT went to gender-blind admissions and the percentage of women went up. Then there was a whole discussion – I think it was in the 80s – where the admissions policy was changed to include more about being a human being and particular accomplishments, overcoming adversity, background – all this kind of thing. And there was outcry against it, because "our standards were going to be lowered."

BALWIT: I didn't know that.

NELSON: I really like the MIT values and I've continued to like them. It must have made for some interesting decisions when my friend who was on the board for a

while... the decision to keep the place small is a conscious decision, and means a different kind of place.

BALWIT: I like it. I like it that it's small. My cousins and uncles came to visit yesterday, and we walked. And between campus and Newbury Street we ran into five people that I knew!

Anyway, I'm wondering: What were some of the lessons you feel that you learned at MIT? Not in class.

NELSON: Well, one of the big things that I learned, and I didn't learn it until much later, was the importance of the social process. If I had been more conscious of it, I think, when I was at MIT, I would have been able to work it better. But because of some of the things that went so wrong, I learned that later, that I could speak up for things. Ask for what I wanted – things like that. Well, kind of understand more. That was a big one.

Another thing I've learned is that I love "going overboard," as my mother called it. It's a joy to work really hard on something for a long time and to try to understand it fully and produce excellent results. This also seems to be an MIT characteristic. I worked hard in my career, in meditation, in photography, and currently I'm working hard on heavy weightlifting.

BALWIT: Would you give that as advice for people who are at MIT now?

NELSON: I don't know about advice, because, you know, because situations are so different. But alertness never hurts. To really look and see what's going on. Another thing that I sort of have learned over the years – and I started this at MIT – is to look for the real reward system and not the stated one. See what is really getting rewarded. That's been tremendously helpful.

At MIT, the division between what's in class and not in class is not that sharp, which is also something I love, and I've carried that with me. I have a lot of friends who make a very sharp distinction between their work life and the rest of their life. I think at MIT I couldn't do that, because it wasn't defined to have these separate parts. I know people who don't think you should talk of serious things at a party. Or they don't tell their families even as much as they are allowed to tell about what they're doing. I think my MIT experience really helped me not do that. Not make those separations.

One of the things we used to talk about at MIT was how, if you learned something in one class well, you had to map it to what you were learning in all the other classes in order to learn these things and survive. You

couldn't survive the rate of learning without making all the connections you could possibly make – let alone just allowing it.

Doing math, it's very famous that when you're really stuck, you take a shower or you look at the sky – let your mind relax rather than trying to focus. I started doing that at MIT. It has been really important. When you're trying to understand something you have just to live with it and not just at some times. You can allow it to be there all the time, in between everything else. And then, you know, insights will come to you, readily, than if they are allowed to happen only some of the time.

My passion is how everything works. Part of that everything is us, brains and minds. That's such a rich area. Outside-inside really doesn't matter. And integration. It's a very loose, flowy integration. It's not forcing things into a shape, but allowing them to not have edges and not to have boundaries. And then looking for whatever shapes emerge but not holding them solid.

I was just thinking that that's such a mathematician's way of looking at things. I went with an engineer friend of mine, Becky, to visit a friend of hers who had been a mathematician and was now being mostly a potter. And the two of us mathematicians started talking about math and the aesthetics of it and, you know, moving our arms – it's very kinesthetic. Becky observed, "Oh, mathematicians are different from engineers." We were just so into the movement of things.

BALWIT: I'm really into pottery, too.

NELSON: Oh, neat!

S&S Restaurant [site of this interview, in Inman Square, Cambridge] has a very special meaning for me. I've been coming here for years, but when it was quite small. Also, two of my MIT friends got married here, well they got married in the chapel and they had their reception here, I think it was in that room. Both mathematicians. Carol is a major potter. She invents glazes. I forget where they're living now, but she just like really went into it in that MIT way over your head MIT style. My daughter does pottery, too, when she can. She's got two babies now.

BALWIT: It's hard.

NELSON: She doesn't have time to do anything. And she's working full-time.

BALWIT: How many kids do you have?

NELSON: I had two. My son died in 2005. My daughter [Prof. Diane Nelson, Senior Lecturer in Linguistics, University of Leeds] is doing well. She and her kids are coming next month. I go to England and Turkey to see them. They're good about coming here, too. She's a professor. She got her Ph.D., even if I didn't. I am so glad about that!

BALWIT: That's a real accomplishment.

NELSON: I think so. I think it's her accomplishment. But this is another thing that I think is really important: the importance of models, of role models. She is really grateful that I had an actual career. She says most of her friends' mothers, either they didn't really have a career or it was secondary to the husband's. And she says the fact that I really did all these things and that I got into all these exciting things when they were just starting has really helped her. That's really a good thing to hear from a kid. Wow! She got her Ph.D. from Edinburgh, in linguistics, Finnish syntax. And she's had a job at Leeds University pretty much since then. She lives in Leeds, and the kids are learning about nature and learning about art.

BALWIT: Sounds wonderful!

NELSON: And speaking Turkish and English. Well, English more. They are three and a half and one and half-ish, a little bit more than that now. Girls.

BALWIT: Do you have any other favorite stories or reflections to include?

NELSON: I think the only thing is that I wish that I had gone to MIT understanding more, even though that doesn't make a whole lot of sense. Considering that I was young.

It was rich, and it could have been even richer. I might have done something different in graduate school. I also think about friendships. I see some of my MIT friends. I don't know what it's like now, it's much more half and half, but with so few of us [women] there, the friendships have been very strong and very enduring. It's astonishing.

BALWIT: I can imagine.

NELSON: And my friends are from classes around mine, as well as mine, because we hung out together and chatted. Just amazing friendships with women formed at a place that had so many men. And actually, that's a big thing, not a little thing.

One of my meditation teachers actually commented that I can be friends with both men and women, and many women and many men can't. I think that MIT really helped that, and I suspect it still does. Just because you are around both, but with this common MIT-ness, and interest in things and learning things.

That's really a great basis for a friendship. You can be very connected, when you are trying to work something out. I think gender is not the first thing that you use to decide how everything is. It's probably even more important now, because the rest of society is starting to be less focused on it, but there's so much else in a person.

BALWIT: It's been good talking to you!

NELSON: Well, thank you!