WOMEN OF WISDOM

TALKS WITH WOMEN WHO SHAPED OUR TIMES

Grace Murray Hopper

By Lynn Gilbert

with Gaylen Moore

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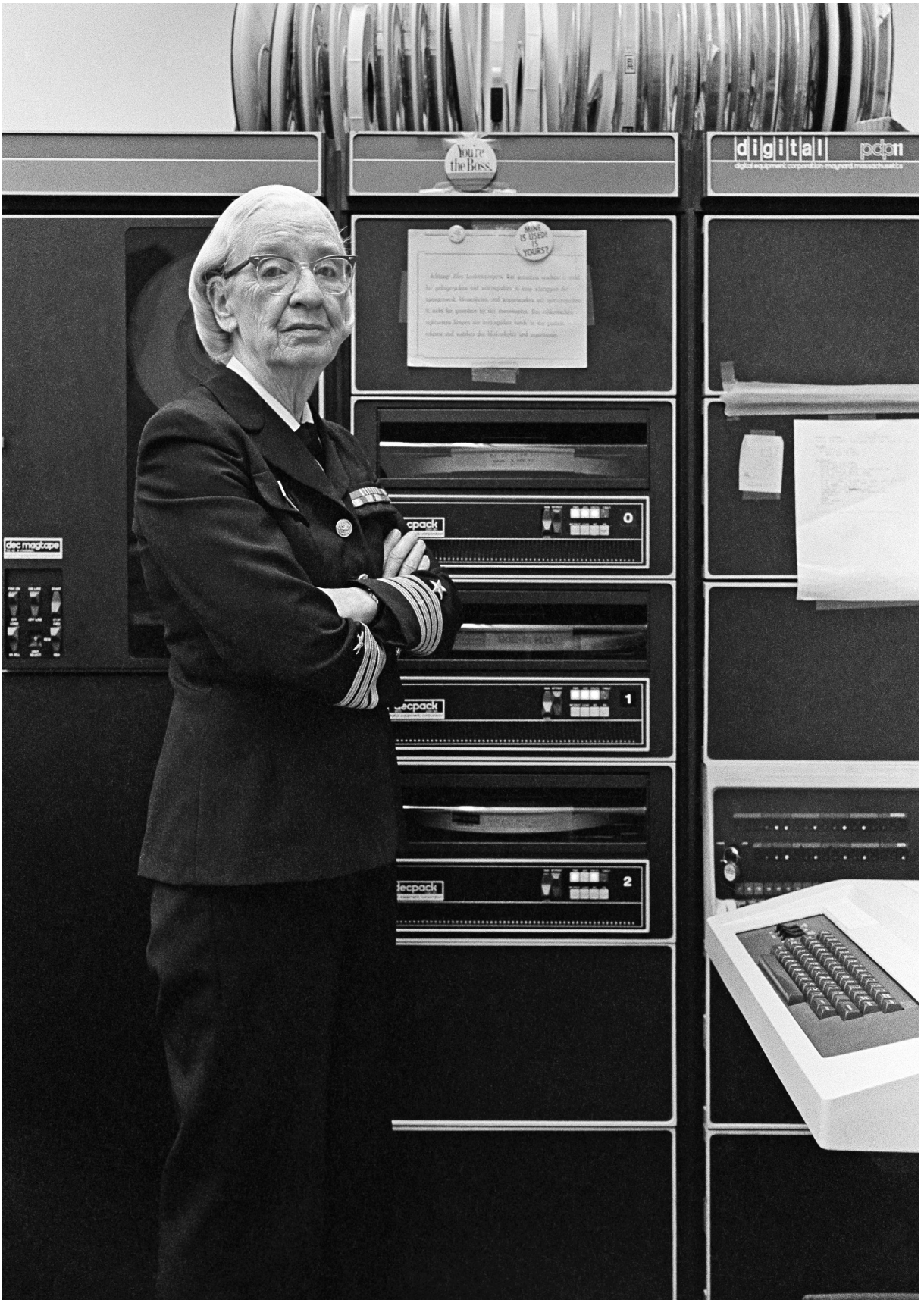
Dedication

To the women of the past, who made a difference,
the women of today who keep the goal of equality aloft,
and the women of tomorrow in whom we entrust our future.

— Lynn Gilbert



Grace Murray Hopper in her office, photograph by Lynn Gilbert ©1978, Washington D.C.

Grace Murray Hopper

(born 1906, New York City—died 1992, Arlington, Virginia) was a mathematician who, while working with the world's first digital computer in the 1940s, developed the concept of automatic programming with a compiling system using words instead of mathematical symbols. From this concept she helped develop the computer language called COBOL (Common Business Oriented Languages), used today in data processing.

I WAS BORN WITH CURIOSITY. I always claim that I had a strong resemblance to the elephant's child in Kipling's *Just So Stories* who pokes his nose into everybody's business. Finally the alligator latches onto his nose and the elephant's child is pulled away and his nose gets stretched.

I remember when I was about seven, we had seven bedrooms up at our summer home for all the cousins to come visiting. Each room had an alarm clock, one of those round ones with two feet and a bell up on top that rings like crazy when the alarm goes off. When we were going on a trip, Mother would always go around at night and set all the alarm clocks. One night she went around to set them and they had all been taken apart. What had happened was that I'd taken the first one apart and I couldn't get it together so I opened the next one. I ended up with all seven of them apart. After that I was restricted to one clock. It's that kind of curiosity: How do things work?

I was very fortunate in that my father believed his daughters should be given the same opportunities as his son, so my sister and I both went to Vassar. It was a little unusual back in those days. I was class of '28 and my sister was class of '30. Mostly the only people who went to college then were going to be schoolteachers. But my father had seen the panics of 1893 and 1907 and he said he might or might not be able to leave us any money, but he could see that we were trained.

I loved mathematics all the way through school, especially geometry. I used to draw pretty pictures with it. It's not really unusual for a woman to have an interest in mathematics. Actually I think you'll find an equal number of girls have it as boys. They just get discouraged when they're younger. They hit a hard problem and somebody's apt to say, "Oh, girls can't understand that." They're not encouraged by teachers or parents. That didn't happen to me. As a matter of fact, my sister made all As in math too, though she was an economics major.

During World War II, and right after the war, when the men came back, they were all busy going to college and getting their degrees, so the women got in on the very beginning of the computer field and they've stayed there. It's probably one of

the best fields there is for women to move up in. Women turn out to be very good programmers for one very good reason: They tend to finish up things, and men don't very often finish. After men think they've solved a problem, they want to go off and get a new one, whereas a woman will always wrap it up in a neat package and document it. I think that's because you don't half-cook a dinner, you finish it and put it on the table, or you put the snappers and buttons on a dress. We're sort of used to finishing things.

I was an associate professor of mathematics at Vassar when I went into the navy. I joined the navy because there was a war on and everybody was going into something. I'd had a grandfather who was a rear admiral and I would have loved to have been in the navy from the beginning but at the time when I was growing up they didn't take women.

The navy assigned me to the Bureau of Ordnance Computation Project and sent me to Harvard to work on the first computer in the United States, the Mark I. Nobody knew anything about computers then. That was the first one. The Mark I computer was fifty-one feet long; today a computer with similar powers is about three eighths of an inch, a chip, an integrated circuit.

When we started programming computers we had to write all the programs in octal code (that's base 8 instead of base 10). When you start doing that, you can sure make mistakes. So what I had done over time was to collect pieces of code to compute a sine or a logarithm or some such function that I knew was checked out and knew was correct so that I could use them again in another program. I kept them in a notebook. But to put them in a new program I still had to copy them and add them to all the addresses. Copying and adding them to addresses is a very dull occupation and I found I made mistakes. And there sat the big computer. It would do it. So I decided to make a library of all these pieces of code and I'd give them each a name and then I'd tell the computer to put them together, copy them, and add them to the addresses.

So I built the first compiler. It was a mathematical compiler. It translated mathematical notation into machine code. Manipulating symbols was fine for mathematicians but it was no good for data processors who were not symbol manipulators. Very few people are really symbol manipulators. If they are they become professional mathematicians, not data processors. It's much easier for most people to write an English statement than it is to use symbols. So I decided data processors ought to be able to write their programs in English, and the computers would translate them into machine code. That was the beginning of COBOL, a computer language for data processors. I could say "Subtract income tax from pay" instead of trying to write that in octal code or using all kinds of symbols. COBOL is the major language used today in data processing.

No one thought of that earlier because they weren't as lazy as I was. A lot of our programmers liked to play with the bits. I wanted to get jobs done. That's what the computer was there for. When I started with the first compiler, nobody really believed it. I went to a meeting and gave a paper on it, but nobody said, "You can't do that." It took two years before they began to accept that concept. They had to because it worked.

Right after the war there was a tremendous surge of innovative development in computers. Everything was changing. In weaponry, where you used to fire shells you now fired rockets and missiles. We were talking about guided missiles, about airplanes, and they all needed a tremendous amount in the way of design and computation; the need for computers was very great.

Then when we started with the space effort, it became even greater because you had to plot the courses for things and you had to put computers on board. They had to be smaller and lighter. There was tremendous support for innovation in all areas.

I think one of the reasons we're not getting those kinds of innovations today is that government support has almost totally disappeared, and with inflation, com-

panies themselves have cut back on the amount they spend on research. They may spend the same amount but because of inflation it doesn't have as much effect. You'll notice that much of the equipment we're using today is the result of the work done right after World War II—the forties and early fifties.

That hasn't affected my work because I'm concerned with using the computers to do things. Most people don't know much about the microcomputers, the chips; they don't quite understand them and it's hard to believe that what used to be in a big blue box can all be on one chip. It's a little hard to explain it to people. Sometimes, you have to prove it. What we're up against is people's resistance to change. I have a clock on the wall in my office that runs counterclockwise. That's so nobody in the office can ever say we've always done it this way. It tells perfectly good time. It just shows there was never any good reason why clocks had to go clockwise. What bothers me is the number of people who can't change, who say, "We've always done it this way, don't make waves."

When I was young, I was already on my way to take off. I don't know why, I just was. My family had a lot of confidence in me. After the war I worked for UNIVAC. I worked there from 1949 until 1967 when I became a senior staff scientist. I can remember once I went to the general manager of UNIVAC to get some money or people, I've forgotten what I was trying to get. He said no, and I said, "Okay, I'll quit. I'll clean out my desk and leave this afternoon." He beckoned me to come back and said, "Wait a minute, Grace, you've already done that once this year, you can't do it again." I always figured I could get a job as a waitress. It would have been temporary. You must stand on your own two feet. That's half the fun.

The contemporary malaise is the unwillingness to take chances. Everybody is playing it safe. We've lost our guts. It's much more fun to stick your neck out and take chances. But you see, we've provided for everything. Everybody's wrapped in cotton batting. It used to be if you lost your job, you went out and got another one or you didn't eat. Now you get unemployment insurance. Don't eat saccharin,

don’t do this, take care of that, fasten your seat belt. The whole attitude is protect yourself against everything, don’t take chances. But we built this country on taking chances. Instead of going to higher echelons and saying, “Can I try this on my computer?” I do it. If it works, I get a pat on the back; if it doesn’t work, I try to explain why it didn’t; but I don’t wait for somebody to tell me to do it.

Safety, security, no change, that’s what a lot of people have been taught to value. It’s the old pioneer spirit that’s lacking. I had an ancestor who lived in Newbury, Massachusetts, and got tired of it. There were about three hundred families and he thought it was getting too crowded so he piled his family and possessions into a wagon and went up and founded Boscawen, New Hampshire. How about the people who came over here in the beginning who were dissatisfied with things the way they were in Europe? They embarked on little tiny boats and came three months across the North Atlantic looking for something better. How many people would do that today? We could start settling in space, couldn’t we? There were people in Europe when the early ones set sail who said the same thing: “Really, is that possible?”

The most important thing I’ve accomplished, other than building the compiler, is training young people. They come to me, you know, and say, “Do you think we can do this?” I say, “Try it.” And I back ‘em up. They need that. I keep track of them as they get older and I stir ‘em up at intervals so they don’t forget to take chances. Once in a while I’ve had to tell somebody that they were falling into a rut, that they had greater capabilities than that and why didn’t they get a move on . . . you know, hold a small conference and give ‘em a little boot in the rear. People in a way are very much waiting for someone to express confidence in them, and once you do it, they’ll take off.

I never thought about what I wanted to accomplish in life. I had too many things to do. I was so deeply involved in things, I just kept on going. Then something came along and changed the direction. I went off with it. I didn’t know where it was going to lead me. It just keeps on leading me.

I'm still on the CODASYL committee that monitors the COBOL language, but I've gone off into this business of trying to build systems of computers instead of one big computer. Now that we have the chips, instead of using one big computer to do all the jobs, we can use separate computers for each job and have them all running parallel and talking to each other.

I've gotten away from the mathematical side of computers. I'm over on the data processing side, the business side, because that's more exciting. You don't have equations, you're dealing with people, and they don't obey equations. I'm working with computers to run the navy now. We use computers to supply petroleum, ammunition, people—send orders for training, move 'em around the country. You don't do anything in the navy without a piece of paper, and they all come out of computers. Same thing's true of your big companies. If those computers stopped, this whole country would come to a screeching halt. If we didn't have computers, we'd be solving these problems on paper and some that we do in an hour would take three hundred years. Computers are tools; they can be misused by people. If I have a wrench in the garage to fix the kitchen sink, someone can come and hit someone over the head with it, but it wouldn't be the wrench that did it, it would be the person. So when we write laws, they shouldn't be laws about computers, but laws about the people who use them. We're developing very good techniques for keeping unauthorized people from plugging into the computer system.

My vision of a world with computers is a world in which people have a lot more time to do what they like, to do what they want to do and read the books they want to read. It won't make books obsolete, it's too tiring to read on computers. Playing tennis, jogging . . . they'll have plenty of time to go to the shore. I'd go over to the library and start digging through books. I could do my work at home. I could have a computer at home and talk to my office. I could live up on top of a nice mountain in New Hampshire and smell pine trees and it would be the same as if I were here in the sub-sub-subbasement of the Pentagon. I think that would be much better. I'm not afraid to live in a world like that. I would hate to go back to wear-

ing cotton knitted stockings; I like nylon. I wouldn't go back for anything. Change is slow. You have to see the contrast. I think you have to live seventy years before you get to see it.

The navy retired me from the reserves on December 31, 1966, and recalled me to full active duty on August 1, 1967. I'm seventy-three years old. Now I'm very much interested in genealogy. When I can sneak a few minutes, I go to the library. My interest in genealogy started with my own family because when Mother died, I'd found she'd gotten part way and I thought I'd finish it, but now I'm ending up studying early American history. My mother's family goes way back to before the American Revolution. When I started tracing these things I realized that in school they taught us that the Pilgrims landed in 1620 and in 1773 we had a Boston Tea Party, and I discovered I didn't know anything that had happened in between, which was the time of the development of town meetings and our political system. So I started finding out how our system developed.

I told you, I have insatiable curiosity. It's solving problems. Every time you solve a problem, another one shows up immediately behind it. That's the challenge. Nothing ever stays the same, it's always new and different. Anybody who's been bitten by the computer bug and had the fun of making those things do things in the fraction of the time you used to take doing them and make them do all sorts of things you never had any chance to do otherwise, why you can't let go of that, you want to keep on doing it. I'll never finish my work with computers, any more than I'll ever finish the genealogy because the generations double with every step. Wouldn't it be dull to do things that ended? I'm having a heck of a good time and contributing a little bit here and there to solving problems.

PARTICULAR PASSIONS

recounts the rich oral histories of pioneering women of the twentieth century from the fields of art and science, athletics andlaw, mathematics and politics.

We share their journeys as they pursue successful paths with intelligence and determination, changing the world for the millions of women and men who were inspired by them.

This is one of 46 stories that will captivate, educate, and inspire you.

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