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To give WITI Members some perspective, Jean and Timothy Bartik revisited how the six "Women of the ENIAC," WITI Hall of Fame Inductees Kay Antonelli, Jean Bartik, Betty Holberton, Marlyn Meltzer, Frances Spence and Ruth Teitelbaum, fit the criteria for induction into the WITI Hall of Fame in 2005. All the Women of the ENIAC were already inducted to the WITI Hall of Fame in 1997.

WITI audaciously asked the Bartiks, as a writing exercise, to fill in the nomination form once again. They graciously agreed to take the WITI challenge with pride. Below are the questions from the 2005 Nomination Form and the responses from Jean and Timothy.

WITI Hall of Fame Criteria and Required Questions

Hall of Fame recipients include women who have made outstanding contributions based on one or more of the following criteria:

1. Directly made an exceptional contribution to the advancement of science and/or technology.
2. Facilitated and created programs that motivate young women to choose careers in science and technology.
3. Enabled and encouraged other scientific and technical women to advance in their careers
4. Created scientific or technological innovations, which promote environmental harmony, support humanitarian endeavors or improve the human condition.

Based on the above recipient criteria, please answer the following questions. Answering these questions is required. Please give thorough and complete answers to questions below.

1. Based on the criteria above, which of these criteria best describes the outstanding contributions of the nominee and why?

The Women of the ENIAC, Kay Antonelli, Jean Bartik, Betty Holberton, Marlyn Meltzer, Frances Spence and Ruth Teitelbaum, directly made a contribution to the advancement of science and technology by developing the first programs or software for the first electronic computer, the ENIAC, in the mid 1940s.

The ENIAC's development led directly to the development of the computer industry, as the ENIAC and its successors, such as the UNIVAC, soon became used by government and business, and attracted competitors like IBM into developing similar electronic computers.

The Women of the ENIAC created the field of programming, which quickly became at least as important as hardware in determining the usefulness of computers. At the time that the ENIAC women did their initial work, they were the only programmers of general-purpose electronic computers in the world.

These women developed the formats for flowcharts and programming techniques. They did this on their own because there were no manuals for the ENIAC or books on the subject. They developed their programs using the logical block diagrams of the ENIAC. They developed the techniques for debugging their programs as well as the ENIAC.

In addition to helping develop the techniques of programming, which carry on to this day, the ENIAC women's programming and debugging of the ENIAC were crucial to helping identify problems in the ENIAC's design and operation, so that the computer could operate usefully and effectively.

The critical importance of software creativity to the improvement of hardware continues to be important to this day, although the importance of software had not been obvious to the men who originated the idea of the ENIAC.

2. Please discuss all the other criterion above which describes your candidate as thoroughly and completely as possible

With respect to criterion (2), when young women in science and technology, particularly in computers, have learned about the ENIAC Women's history, their emotional experience has frequently been one of awe and inspiration, and as detailed below, the Women of the ENIAC have been willing to frequently share their experience with girls and young women.

With respect to criterion (3), the Women of the ENIAC have encouraged young women in computer science and other scientific fields not only through their example, but in many cases through training or mentoring other young women in computer programming.

In addition, the Women of the ENIAC supported each other. These women had never heard of Lady Lovelace, although they would have been delighted to meet such a kindred woman. These women developed a close relationship with each other. They could discuss their work and ideas with no one else because no one else knew what they were doing. They worked together and spent a lot of their free time together going out to dinner and talking.

The conversation might start with whom was dating whom, but it quickly changed to what could be done with the ENIAC and other computers to come. One could say this was the first women's computer organization in history.

With respect to criterion (4), the computer industry is obviously a field with enormous potential for social usefulness, depending upon how the power of the computer is used. As an example of an ambiguous contribution of the computer, one of the first uses of the ENIAC was to test different alternative designs for the hydrogen bomb. This power of the ENIAC may have helped national security, but may have also contributed to the arms race.

In addition to the ENIAC, some of the ENIAC women went on to make further contributions to the development of the computer and software industry. Although Ruth Teitelbaum, Frances Spence and Marlyn Meltzer married and left the computer field, Jean Bartik and Betty Holberton continued.

Betty Holberton was the 13th person hired at the Eckert-Mauchly Corporation, which developed the BINAC (BINary Automatic Computer)

and the UNIVAC (UNiversal Automatic Computer), the first commercial electronic computer.

Betty Holberton specified the instruction set for the BINAC; the first computer built using a stored program. It preceded the EDSAC by a few months. BINAC was the first computer designed to be an on-board computer for a missile. It was designed as twin computers to guide the Snark Missile. Snark never flew. The BINAC was too heavy and the Snark was cancelled. Jean Bartik programmed the Snark trajectory problem.

Both Jean and Betty worked on the logical design of UNIVAC. Betty's main contributions were to the C-10 code that was the instruction set for UNIVAC. She also designed the Console, its elegant control. She also did what is probably the first higher-level language for a computer. She developed a Sort/Merge Program where one could produce a sort/merge routine for any application including tape labeling by putting in 18 parameters. It was distributed to all UNIVAC I users.

Jean Bartik along with Arthur Gehring produced a logical design for a back up to the mercury delay line UNIVAC in case it didn't work. This back-up computer used electrostatic storage and was microcoded, probably the first microcoded machine. It was never built and the electrostatic CRT (Cathode Ray Tube) was found to be too unstable to be a computer storage medium. The mercury delay line memory worked. Jean and Art also put in all the UNIVAC check circuits other than the odd/even check on the memory.

Betty Holberton went on to work on the COBOL Committee which developed the language so the "boss could understand" what was being programmed. She also became the driving force behind the standardizing of FORTRAN. She was sent in to check up on the FORTRAN Standard after the committee had determined it was finished and disbanded.

She found that she couldn't program using it. She called back the committee, which toiled for a number of years before a workable standard was developed. She programmed the routines that would test whether a FORTRAN Compiler met the Standard that truly was a standard. Grace Hopper called Betty Holberton the greatest Programmer she ever knew.

3. How have this person's accomplishments impacted science and/or technology?

The modern era began with the Women of the ENIAC. As "computers," during WW II, they did the trajectories on the differential analyzer and on hand calculators to create the firing tables that troops in the field used to tell them what the gun elevation should be for the shell to hit a distant target.

United States defense and military operations today depend heavily on computers for our security. Health records and CAT scans allow examining the body without making it a cadaver. The storing of masses of data makes research no longer confined to isolated little enclaves but opens it up to the world.

4. Has the nominee's accomplishments impacted the business or social community? If so, how?

It is laughable that when Eckert and Mauchly sought loans for the development of the UNIVAC, bankers saw no way that they and other businesses could profitably use computers.

It is hard to imagine the world without computers or programmers. We could have no space program. We could have no Internet. We could have no Google. We could have only a rudimentary airline reservation system. We could have no ATMs. The personal computer of today and the ENIAC are far different, but the PC is a descendant of the ENIAC.

At the time the ENIAC Programmers were hired, the conventional wisdom was that programming a computer was a clerical task. After all, it involved keypunching cards and setting switches. One just sat down and followed formulas and translated them into switch settings. Then they set the switches and plugged in cables in program and digit trays.

Women's work "Programming"- as a career- began with the women of the ENIAC. Their competence, skills and hard work made it a worthy and respected profession for women. They did so much more than anyone expected.

Indeed, the ENIAC engineers were astounded that they could leave the debugging to the women "Programmers." They respected and loved the Programmers because they could go off and design EDVAC and not worry about the messy job of cleaning up the ENIAC.

5. Are there any challenges the nominee had to overcome in order to achieve these accomplishments? If so, please describe them.

Alas, the computer historians ignored the ENIAC Programmers until Kathryn A. Kleiman and Tom Petsinger rescued them from obscurity. When Jean Bartik was working in Northern New Jersey, she was invited to a Computer Pioneer Symposium with all male attendees, no other ENIAC technicians. No other women were there. She wrote a letter to Professor Brainard of the U of PA, who was the chairman, saying she thought it was a disgrace that there were no women speakers. As a result, she was asked to speak at that event. Kay Antonelli was asked to speak at the 40th Anniversary of the introduction of the ENIAC, as John Mauchly's widow, not as a pioneer herself.

Kathryn A. Kleiman was a student at Harvard, writing her senior paper on the women in computing when she saw a reference to the ENIAC Programmers. She came to the 40th Anniversary Luncheon and met the ENIAC Programmers.

When the 50th Anniversary rolled around she called up Steve Brown, who was organizing the celebration for Penn, and asked him what he was doing about the ENIAC Programmers. He said he wasn't doing anything. He had no documentation on them. Kathryn began to provide documentation but mainly to Brown's secretary.

Meanwhile Tom Petsinger, a reporter at the Wall Street Journal, heard there were ENIAC Programmers. He also called Steve Brown to ask what he was doing about the ENIAC Programmers. Tom talked only to Brown's secretary. She told him that he sounded like a woman who was asking the same questions and did he want her telephone number.

Tom and Kathryn got together and Tom spent a day with each of the ENIAC Programmers interviewing them. He decided to do something with the story and, in November, 1996, he wrote 2 stories that ran on succeeding Fridays in "The Front Lines" column in the Market Place section of the Wall Street Journal. The power of the press and Kathryn's determination rescued the ENIAC Programmers from obscurity.

6. Has the nominee received any scientific and/or technological awards?
Please list them.

All of the six women ENIAC Programmers were inducted into WITI's Hall of Fame in 1997: Kay Antonelli, Jean Bartik, the late Betty Holberton, Marlyn Meltzer, Frances Spence and the late Ruth Teitelbaum. Kathryn Kleiman was present during their WITI Hall of Fame Induction and was able to see them honored as she might have imagined in front of thousands of people in the computer industry. People cheered and clapped and cried.

Kay Antonelli received an honorary Doctorate from Chestnut Hill College. Jean Bartik's Alma Mater named its computer museum after her. It is the Northwest Missouri Jean Jennings Bartik Computer Museum in Maryville, Missouri. They also gave her an Honorary Doctor of Science Degree. In addition, the server for students at Bryn Mawr College is named "Bartik" after her.

Betty Holberton received many awards. She received the Ada Lovelace Award, the highest honor given by the ACM for Women. She received an IEEE Computer Pioneer Award. She received a number of awards and commendations for her work on FORTRAN and for programs she developed for the Federal Government, such as one she received from Eisenhower for combining the insurance policies for the military.

Betty was amused about a commendation she received for writing a simple little routine that printed out bio information on a visitor when the receptionist typed in the name. Both Betty and Jean were charter members of the Association of Computing Machinery, ACM.

7. How has the nominee shared her expertise, accomplishments and time in order to help other people or women peers/ young women advance and/or choose careers in science and technology?

From the beginning, teaching was one of the major jobs required of the Women of the ENIAC. Nobody knew anything about computers or programming. Teaching users, teaching other Programmers, interacting with other people in the business, and sharing information was common courtesy and necessary. ACM was started to share information.

People began to pour out to computer conferences. From this pioneering handful, the circle "in the know" grew larger and larger. The ENIAC Programmers were role models for those who followed. Betty and Jean always spent a lot of their time teaching others. Kay and Jean have

appeared at many universities, high schools and other groups telling their stories. They are always surrounded with groups of girls asking questions and seeking autographs and advice.

8. In a summation, can you describe in two sentences why your nominee should be inducted to the WITI Women in Science and Technology Hall of Fame? Please incorporate the ideals of the criteria into this statement.

The ENIAC Programmers, the Women of the ENIAC, (Kay Antonelli, Jean Bartik, Betty Holberton, Marlyn Meltzer, Frances Spence, and Ruth Teitelbaum) began the era of the computer Programmer. They embraced their work with excitement, fervor, creativity and competence and made computing a respectable career for women, a profession which has become indispensable to society and humanity.

9. Are there any other factors that should be considered in selecting this person to the WITI Hall of Fame?

Unfortunately, today, it is still too often true that the computer industry is stereotyped as a "male industry". The example of the ENIAC programmers forces people to rethink that assumption. To many people, it is a shock to learn that at one point, all the computer programmers in the world were women: there were no male computer programmers.

The ENIAC women's example is perhaps one of the best vehicles for questioning stereotypes and expanding society's definition of what women can do.

The ENIAC women love science and math and believe that men shouldn't have all the fun pushing back frontiers. Kay and Jean have spoken to many groups, but Jean's Bartik's biggest thrill was speaking to women in a Nursing Home who whistled and cheered when she finished speaking about her epic and pioneering life.