Panupong Leenawarat

Dr. Emily Redman

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Human Computers Were Rewarded by Computerized Mechanisms that Replaced Their Jobs and Even Their Names

In the early 17th century, computers did not consume electricity but food. Computers were not made of microchips or CPUs. At that time, they were human. The idea "computer" appeared around 1613 before the first computerized mechanism would invent in the 1820s by Charles Babbage. During the term "computer" first used in people, computers used to wear a skirt during the period of Sir Isaac Newton. Many women were employed as human computers in many fields of science. Human computers were very useful to perform mathematical calculations. Large problems were broken down into discrete parts that were process by hands. Human computers worked behind many scientific discoveries. However, many famous scientists in history of science such as Claudius Ptolemy, Galileo Galilei, and Isaac Newton did the computations by themselves with friends or students instead of hiring a staff of computers. Human computers were used in various fields in history of science, especially in astronomy.

The story of the first organized computing groups emerged when a serious attempt to predict the date of the return of Halley's comet in 1758 by a French mathematician named Alexis-Claude Clairaut (1713–1765). The eighteenth century up to 1880, astronomy was the dominant field of scientific research that required the greatest amount of calculation. In the

book, *When Computers Were Human*, David Alan Grier offers the first in-depth account of these workers. He writes "Newton's calculus would never provide a simple way to describe the motion of three or more bodies and hence would never give an accurate date for the comet's return." During that time the calculation of comet's return required computational techniques beyond the mathematics that scientists had. It was therefore Clairaut divided the computation to two friends, Joseph-Jérôme Le Français de Lalande (1732–1807) and Nicole-Reine Étable de la Brière Lepaute (1723–1788). Clairaut thought that Newton's mathematics were not enough to solve the problem but developed necessary mathematic in his paper, *An Inquiry concerning the Figure of Such Planets as Revolve about an Axis, Supposing the Density Continually to Vary, from the Centre towards the Surface* in 1738. Clairaut suspected that "he [Newton] overlooked through the abundance of those fine discoveries he was in pursuit of" (Clairaut, 277). Nevertheless, Clairaut wrote to advertise Sir Isaac as "the great author" of *Principia* (Clairaut, 277). *Principia* was used as foundation to build on his own ideas. For example, Clairaut extended Newton's calculus and developed his own method to handle three-body problem and others problems in astronomy. Eventually, Clairaut and his computers could predict the date of the Halley's comet would return again in 1759.

Although human computers handled the similar works as scientists, they were treated differently in the past. In 20th century, there were more racial minorities working as human computers. Black people were discriminated to work as a scientist because the majority of scientists at the time were white. The reason why black women studied to become a human computer was because there was nothing else they could do to get a place in scientific world. At least, they were the one who did the hard-computational labor of science. In Margot Lee Shetterly's book *Hidden Figures: The American Dream and the Untold Story of the Black*

Women Mathematicians Who Helped Win the Space Race, the book focuses on three real-life African-American female pioneers: Katherine Johnson, Dorothy Vaughan, and Mary Jackson, who were part of NASA's team of "human computers." They were behind the success of John Glenn orbited the earth and Neil Armstrong walked on the moon. Most of the black women at NASA at the time were relegated to a building for "human computers" which was separated from the main campus. From the book, when Katherine was assigned to work in a different building, she was forced to walk half a mile to use the "colored" women's restroom. Although, it was common practice for black women who worked at work places in those days, they were not treat as a scientist and limited to the role of human computer. Human computers were discriminated by other scientists on the basis of skin color and job title.

One of the most important work by Annie Jump Cannon, who was hired as a computer in 1890, led to the most important future astronomical discoveries. Cannon sacrificed the most of her life time to classify and devise all known over 350,000 stars in the sky based on their spectra. She had a co-worker named Henrietta Swan Leavitt. Leavitt continued to work with what Cannon had done. It made Leavitt to discover one of the most important astronomical discoveries of the 20th century. Her study allowed astronomers to measure the distance of objects in the universe. Thus, Cannon and Leavitt's research and discovery was fundamental to astronomical research and discovery in the early 20th century. For example, Edward Hubble, one of the leading astronomers of the 20th century, used Cannon and Leavitt's work to discover the first galaxy outside Milky Way. From this, other scientists used works by human computers as groundwork to build their own ideas. Many formulas and theories could never have happened if it were not for the women who calculate and solve mathematic equations including

scientific problems by hand, with pencils and graph papers, often spending longer than a week to finish a work.

During the Second World War and the Cold War, it was a time when human calculations were more trusted than computers. The high of the space race had created a high demand of computation while the new gadget like computation machines were too new and not trusted to come up with the right answers. In *Hidden Figures,* when John Glenn, who the first American to orbit Earth in 1962, asked for Katherine Johnson to check the numbers again after an electronic computer plotted his coordinates. It shows that Glenn was more trusting of a woman than a machine. A mistake figure could cost lives and millions of dollars. Thus, it was the main reason human computers still played a role in many major projects such as the early space program and the development of the electronic computers. The developers of electronic computers often borrowed the human computers of hand calculation to check some numbers that had been produced by their machines. However, only few human computers were rewarded to the invention of the computers. Eventually, after around 1960s, people and big organizations like NASA began to trust these machines more than human computers according to Kerry Kolbe, a journalist.

These people were 200-year epoch in the history of science and technology; why these people were forgotten; what these people had completed. According to Grier, “the few surviving human computers often failed to appreciate the full scope of what they did.” The major reason that human computers were neglected was because they worked as a labor of science, not a scientist who left record of his live on a scholarly article or an acknowledgement in the bottom margin of his masterpiece. Thus, the story of human computers is difficult to tell, as they often left no record of their lives. The story of human computer shares three themes with the history of

science: the division of labor, the social inequality, the involvement of the most important discoveries. However, human error was the most important factor affecting accuracy and also a key factor in aviation accidents from calculation failures. In the case, professionalization took away the place of human computers. Eventually, human computers were rewarded by computerized mechanisms that replaced their job even the name of those people who were called “the computers.”

Works Cited

Clairaut, Alexis. “An Inquiry concerning the Figure of Such Planets as Revolve about an Axis, Supposing the Density Continually to Vary, from the Centre towards the Surface; By Mr. Alexis Clairaut, F. R. S. and Member of the Royal Academy of Sciences at Paris. Translated from the French by the Rev. John Colson Lucas. Prof. Math. Cantab. and F. R. S.” Philosophical Transactions (1683-1775), 1 Jan. 1738, www.jstor.org/stable/103921.

Grier, David Alan. “The First Anticipated Return: Halley’s Comet 1758.” When Computers Were Human, Princeton University Press, 2005, pp. 11–25. JSTOR, www.jstor.org/stable/j.ctt4cgc82.4.

Joskow, Melissa. “From ‘Computer’ to Astronomer: The Role of Women in Astronomy.” National Air and Space Museum, 16 Sept. 2016, airandspace.si.edu/stories/editorial/computer-astronomer-role-women-astronomy.

Kolbe, Kerry. “Man versus Machine in the Space Race.” The Telegraph, Telegraph Media Group, 3 Feb. 2017, www.telegraph.co.uk/films/hidden-figures/space-race-man-versus-machine/.

Shetterly, Margot Lee. Hidden Figures: the American Dream and the Untold Story of the Black Women Mathematicians Who Helped Win the Space Race. William Morrow, an Imprint of HarperCollins Publishers, 2016.