Apollo Guidance Computer

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Technology and Event Description

Technology and Event Description: Social, Cultural or Global Event

On May 25, 1961 in an address to Congress, President John F. Kennedy, stated "First, I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to the earth." (CBS, 1961) The Apollo Program, known also as Project Apollo, was a space program carried out by the United States National Aeronautics and Space Administration (NASA) from 1961-1972. (Loff, 2015). The program had a total of 14 missions and was successful in President Kennedy's national goal, during the Apollo 11 mission, on July 20, 1969, when Neil Armstrong and Buzz Aldrin landed the Apollo Lunar Module (LM) on the Moon. According to NASA, one of the other main goals of Project Apollo was to establish the technology to meet other national interests in space; the technology we will be focusing on that helped achieve this goal is Apollo Guidance Computer (AGC).

Technology and Event Description: Technology

Great technological advances were needed for the Apollo Program to be successful. In short period of time an array new technology was created: spacesuits - including flame-retardant fabric, space food - including a way purify and recycle water, a technology that led to the Dialysis machine, the world's largest rocket – the Saturn V, and the Apollo Guidance Computer (AGC). The Apollo Guidance Computer was the first portable computer, measuring 24 by 12.5 by 6 inches, and weighing 70.1 pounds.

(Tomayko 1988) The AGC was also the first to use silicon integrated circuits (ICs), often referred to as microchips in today's computers. Scott Hubbard, a professor in Aeronautics and Astronautics at Stamford University, who worked for NASA for 20 years stated "There was a major shift in electronics and computing and at least half credit goes to Apollo. Without it, you wouldn't have a laptop."(Gaudin, 2009)

Technology and Event Description: Societal or Cultural Influences

The advancements prompted by the Apollo missions in computer technology and computer science have continued to impact society. Integrated circuits have allowed for computers to be miniaturized, allowing access and utilization by more of the population. The many people that worked with the technology, including Margaret Hamilton, the lead computer scientist for the team that developed the Apollo Guidance software, continue to inspire young minds. Margaret is credited with creating the discipline of software engineering and was awarded the Medal of Freedom by President Barack Obama in 2016 with the words "Her example speaks of the American spirit of discovery that exists in every little girl and little boy who know that somehow, to look beyond the heavens is to look deep within ourselves -- and to figure out just what is possible." (Office of Press Secretary, 2016)

Technology and Event Description: General Education Lens

"History tells the stories of our past to help us better understand how we got to the present." (SNHU, 2023) Looking through the History lens allows us to understand how the advances in computer technology, that were required for the success of the Apollo program, changed the technology that is available today.

Technology and Event Description: Thesis Statement

A historical review of the Apollo program allows us to see how the technological advances made had a great and lasting effect on the computers of today and how we interact with them.

Critical Analysis

Critical Analysis: Impact on Institutions

The computers technology advances made during the Apollo missions for the Apollo Guidance Computer (ACG) have had a great and lasting impact on all institutions including economy, politics, education, community, and family. In the early 1960s computers were large and expensive which made them inaccessible to many; one of the motivations behind the creation of the Internet was to allow computers to be a shared resource for research in educational communities. (Warf, 2018) The funding and interest from the Apollo Missions in the Integrated Chip (ICs), commonly referred to as microchips, lead to mass production, resulting in the cost decrees for manufacturing from $31 in 1961 to $1.25 1971. (Sydney 2022) With the decrease in cost computers slowly

became more available, in 1971 40 of one of the first personal computers, the Kenbak-1, were sold. In 2022 93.7% of US households have at least one computer. (IBIS, 2023) Today, computers are utilized in nearly all facets and institutions of society, including, but not limited to, economy, commerce and global trade, agriculture, politics, education, science, healthcare, transportation, entertainment, community, and family.

Critical Analysis: Social Practices

Computers and their related technologies (smartphones, tablets etc.) have changed social practices since the Apollo missions in the 1960s. The miniaturization of computer technology along with the creation of the internet has made it simpler to make connections with others and easy to gain access to and spread information instantly; it has changed the way we relate and interact with one another and the environment around us.

Critical Analysis: Limitation That Could Benefit From Change

The advancements in computer technology made during the Apollo missions helped lead to the current Digital Age. Today computers are ever-present in day-to-day interactions and are vital to an array of our daily activities; however, desktop and laptop computers are still not equally available, a digital divide exists between income levels. A survey done in 2021 by Pew Research showed that only 59% of homes with an income of less than $30K and 84% of homes with an income of less than 100k have desktop or laptop computers in their homes, in contrast to 92% for homes with income of 100k or more. (Vogels, 2021). Although many tasks that are done on desktop

or laptop computer can also be accomplished on smartphone devices, they are often more challenging. Beneficial changes to the technology would be those that make them more accessible to all and reduce unnecessary electronic waste by needing to be frequently updated. With the utilization of computers becoming more and more common in everyday lives it is important that we work to provide equal access.

Critical Analysis: Strategies to Address the Limitations

Computers were not invented for the Apollo program, but due to the advancements made during the missions the digital divide, between those who had access to computer technology and those that didn't, started too slowly close. However, a digital divide still exists and highly effects households with lower incomes and those in rural areas; these homes have lower levels of technology ownership and access to reliable internet, which is a necessary enhancement for many day-to-day interactions with computers. The COVID-19 pandemic highlighted this divide when millions of students in the US were moved to remote learning, in April of 2020 59% of lower income parents said obstacles such as no computer at home or lack of reliable internet would affect their child's schoolwork. (Vogels, 2021). Distance learning required many schools and governments to work to provide computers and internet access to students, but more work is needed to continue to close the divide. To close the divide, solutions much be found for the root cause, work is needed to make computer technology and internet access more affordable and available. Improved educational services to help increase digital literacy

is important; access to a computer is not very beneficial if the user doesn't know how to use it.

Critical Analysis: Factors That Could Impact Understanding

With the realization that **t**he Apollo Guidance Computer (AGC) was significantly slower and less powerful than today's cellphones (Adobe, 2022), I have found the assumption that a computer wasn't necessary for the success of the **moon landing. H**owever even with its limited power, the AGC made the necessary calculations that weren't possible for astronauts to make. Beyond assumptions, other influential factors that can change an individual's understanding of a technology and its role in an event are bias, values and beliefs.

Critical Analysis: Benefits and Challenges

The positive impact of critically analyzing technology is that it helps understand both how society can be influenced and changed by technologies and how technology can be shaped by the narrative of society throughout its evolution. When we better understand a technology, we can better understand its potential risks and drawbacks, as well as find areas where it can be improved, we consider the impact of the technology on privacy, security and how it changes interactions within society.

Critical Analysis: Strategies for Personal Goals

Critical analysis skills can be used to continually improve and reach personal goals. When analyzing how technology influenced an event look certain aspects, we identify the technology, and gather information to find its intended purpose, benefits, and

disadvantages. The same strategy can be utilized when setting personal goals. First name the goal, identify what you want to accomplish and understand what value it brings. Next, gather information, look for resources and information that can help you achieve your goal, learn from the experience and mistakes of others; but make sure the information is quality and the sources are reliable. And finally, make a plan, think about what steps are necessary to meet your goal based off the information gathered and adjust the plan as needed as new information is presented and you learn from your experience.

Reflections

Reflection: Individual Framework of Perception

Critically analyzing computer technology through the Apollo Missions, including how it was used, how it evolved and the impact that it has on society has helped widen my perspective. The process of researching a topic, including finding scholarly sources to separate the opinions from the facts, allows for further understanding and appreciation of the event and its impact on society. The process of researching a topic allows for personal growth and a deeper understanding of one's conscious bias and sometimes a realization of one's unconscious bias.

Reflection: Bias

"Technology is the application of science to address the problems of daily life." (McGivern, 2016). When a examine my personal bias in relation to technology I know that is changed drastically as I have continued my study in Computer Science. My

conscious bias often agrees with the quote above, the technology encountered in our day-to-day lives often makes our lives easier. As I have studied and learned, I have found I have many unconscious biases as well. Becoming aware of an unconscious bias allows one to gain a deeper understanding of both the bias and the target of the bias.

Reflection: Field of Study or Profession

As a Computer Science major computer technology is my study and profession. Utilizing critical analysis to look at technology allows for an understanding of how bias, in society and in oneself can influence interactions with current technology and development of new technology. As technology continues to grow and touch more aspects of our daily lives it will continue to be every more important to analysis how and what it is used for. An example of this need is shown in AI technology. AI is used in many industries and continues to be implemented in more and more of our day to day lives. Continued analysis of AI is important to understand not only the potential impacts it can have on society, but also to determine bias within the AI. Critical analysis is important to have a clear and informed understanding.

Reflection: Different General Education Lens

A look through the historical lens has shown us the lasting impact of the technological advancements made during the Apollo Program on the computers used today. Revisiting the event from a social sciences perspective, we can see the Apollo Program as a piece of a different picture, a political picture. In a November 21, 1962 transcript, released by NASA, President Kennedy says, “This is important for political

reasons, international political reasons. This is, whether we like it or not, in a sense a race." (NASA, 1962) The Space Rase was a political competition between the United States and the Soviet Union to demonstrate who had superior technology and military firepower.

Reflection: Interactions

Critical analysis requires the utilization of many skills, including, but not limited to observations, evaluations, interpretations, explanations, and problem solving. In interactions with those of a different culture, perspective, or viewpoint, when we stop and use these same skills, we can avoid unintentional conflicts. Computer technology is ever present in the day-to-day lives of many, but it is easy to ignore or forget until something goes wrong. An awareness of the advancements and uses of technology not only helps protect personal privacy and security, but also increases employability, communication, productivity, and educational resources.

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