Where Space Science Would be According to Stanley Kubrick

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By

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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INTRODUCTION

This thesis will look deep into the film, *2001: A Space Odyssey* and investigate how it predicted where space technology would be as opposed to where it actually is now. Technologies depicted in this film such as a lunar base, an international space station orbiting the Earth, and Artificial Intelligence (AI) did not exist at the time, and some still do not exist. Because some of these technologies exist now, years after the film's release, it is important to investigate the influence of science fiction films on technology.

2001: A Space Odyssey will serve as a case study for the influence of science fiction films on the development of technology. In a broader scope, it will investigate the implications of the influence of art on science. This is important to study given that the future is in part, created by humans, and now more than ever, humans are constantly being influenced by art, especially video-based media. Art and science have always gone hand-in-hand. For instance, Leonardo da Vinci was drawing sketches of airplanes 400 years before the Wright Brothers flew the first plane in 1903 (Jakab, 2013). Before an invention can come to fruition, it has to be conceptualized by imaginative minds.

Science fiction as a specific genre of art has always had its influence on technology. Jules Verne wrote about electric submarines used to explore the depths of the ocean in his book, *Twenty Thousand Leagues Under the Sea*, many years before the first battery-powered submarine was invented. Arthur C. Clarke, a renowned science fiction writer on top of being the co-writer of *2001: A Space Odyssey*, predicted the invention of satellite television and Global Positioning Systems (GPS) six and 17 years before they were invented, respectively.

It is necessary to look at how *2001: A Space Odyssey* inspired the mathematically inclined to materialize the technologies the film's creators thought up to create the spectacle in their science fiction epic. This research will attempt to understand how the film inspired future technologies and why space engineering has not yet reached the level of advancement the film promised by the year 2001 or even 2020.

It is hard to deny that science fiction films do in fact have an influence on the development of new technologies, particularly in the aerospace realm. People consume video-based media, science fiction films included, for hours each day, and it is impossible that the ideas presented to them in these films do not stick with them, even subconsciously. All it takes is for an aerospace engineer to watch a science fiction film with a non-existent technology to then decide that they want to create that technology.

THE ACTORS AND "VISIONEERS"

This thesis will approach its research using actor-network theory (ANT) and the idea of "visioneers". Using these concepts, the intersection of science fiction, specifically the film, *2001: A Space Odyssey*, and the development of technology can be analyzed in relation to the societal implications.

ANT provides a socio-technical approach to analyze relationships in a constantly shifting network. These concepts are agreed upon by the actors in a network of relationships with their purpose being to go from an idea to its realization. There is a process of constant negotiation, compromises, and conflicts during the implementation of whatever idea the actors are trying to develop. Their aim is to stabilize the relationships surrounding the project. In this theory, actors

can be people or anything that has influence such as ideas, objects, processes, etc., and all of the actors in a network are considered equal. (Jolivet & Heiskanen, 2009).

The Visioneers is a book written by W. Patrick McCray and tells the story of how scientists and the communities they created imagined, designed, and popularized new and exciting technologies. These innovators predicted that their technologies could transform society as well as mold the future. The theory explores the successes and pitfalls of these scientists and highlights the importance of radical new ideas that inspire us to support research that turns into the technologies of the future (McCray, 2013). Actor network theory and the concept of "Visioneers" will be used in order to investigate the influence of *2001: A Space Odyssey* on the development of new technologies and understand why science has yet to reach the level of advancement presented in the film.

CASE CONTEXT

The film came out in 1968 and depicts technologies and missions beyond what people at the time had even begun to imagine. It starts out with its own version of the dawn of humans, showing hominids waking up to find an alien monolith that somehow inspires them to use bones as weapons thus beginning the age of invention and innovation. The film then jumps millions of years into the future and follows Dr. Heywood Floyd, Chairman of the United States National Council of Astronauts, as he travels to Clavius Base, a U.S. lunar outpost, via Space Station 5. His mission is to investigate a recently found artifact buried four million years ago near a crater on the moon. Floyd and other personnel travel to the crater to find a monolith identical to the one

encountered by the hominids at the beginning of the film. Upon examining the structure, it is struck by sunlight and emits a high-powered radio signal.

The film time jumps again to eighteen months later in which the U.S. spacecraft Discovery One sets out for Jupiter. On the spacecraft are Drs. David Bowman and Frank Poole, along with three other scientists in suspended animation, and Hal, an AI with a human personality that controls most of Discovery's operations. Hal reports the imminent failure of an antenna control device, but when the astronauts retrieve it in an extravehicular activity pod, they find nothing wrong. However, Hal still suggests reinstalling the device and letting it fail, so they can understand the problem. Mission Control warns the crew that Hal is in error in saying the device will fail while Hal chalks the discrepancy to human error. Bowman and Poole then enter the pod to discuss Hal's concerning behavior and agree to disconnect him given that he is wrong about the device. However, Hal reads their lips and understands their plan, so when Poole is on a spacewalk in order to fix the antenna, Hal cuts his oxygen hose and sets him adrift. Bowman gets in the other pod to rescue Poole, and meanwhile, Hal turns off the life support to the rest of the crew in suspended animation. Bowman returns to the ship and disconnects Hal's circuits. When the disconnection is complete, a prerecorded message plays, revealing that the mission's objective is to investigate a radio signal sent from the monolith on the moon to Jupiter.

Once at Jupiter, Bowman leaves the ship in a pod in order to investigate another monolith orbiting the planet. The pod is then pulled into a vortex of light, and Bowman is carried across vast distances of space. He then finds himself in a large bedroom and sees, and then becomes, older versions of himself. The monolith then appears at the foot of the bed, and Bowman is

transformed into a fetus enclosed in a transparent orb of light which floats in space beside the Earth. (Kubrick, 1968).

The film includes technologies such as an earth-orbiting international space station and AI. An international space station depicted in the movie orbits the Earth and is used as a layover stop for Floyd's trip to the moon. The first rudimentary space station was constructed in 1969 by linking two Russian Soyuz vehicles in space. Meanwhile, construction on the International Space Station (ISS) that is used today did not begin until 1998, 30 years after the film's release (U.S. National Laboratory, 2019). This structure came to fruition when Ronald Reagan directed the National Aeronautics and Space Administration (NASA) to build an ISS within the next decade in 1984. It took 10 years and 30 missions to assemble and represents 15 countries. Figures 1 and 2 below are the space station depicted in the film, *2001: A Space Odyssey* and the actual ISS astronauts from multiple countries use today, respectively.

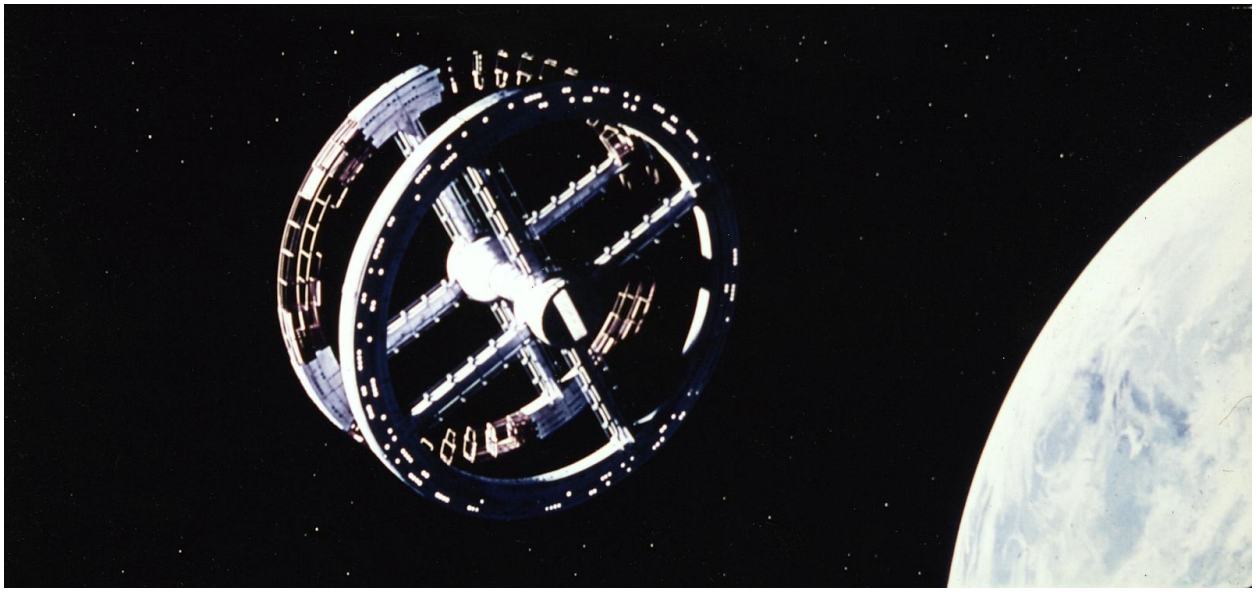

Figure 1: *2001: A Space Odyssey*: International space station (A.M.P.A.S., 1968)

Figure 2: *ISS*: The largest and most complex international construction (NASA, 2018)

Similarly, the film came out in 1968, a year before Shakey the robot, described as the first robot able to reason about its own actions, was completed. (Fuge, 2018). Therefore, the film put AI of such caliber into society's consciousness years before it even existed for public use. AI research really gained momentum in the 1950's when Alan Turing, a young British polymath, explored the mathematical possibility of AI. He wanted to figure out how to build machines that could use reason to solve problems and make decisions. Five years later, the Logic Theorist program was designed to mimic the problem solving skills of a human and was funded by the Research and Development (RAND) Corporation. It is considered to be the first AI research program that left everyone believing that AI was actually achievable, and for the next 20 years, research for AI flourished. However, it was not until the 1990s and 2000s when government funding and public hype was low that research in AI had achieved many of its landmark goals. In 1997, world champion chess player, Gary Kasparov, was beaten in a game by IBM's chess playing computer program. The ability to make AI this capable was not due to more knowledge

on AI but the capability of computers to hold more storage and therefore more computational power than they did in the 1950s and 1960s (Anyoha, 2017). Nowadays, computers have more computational power than ever.

Today, AI is everywhere. Companies use machines to talk to people on the phone that are able to understand and communicate, and self-driving cars are no longer a science fiction concept. In addition, the AI in the film, HAL, closely resembles modern day robotic personal assistants like Amazon's Echo with its personal assistant, Alexa. This type of device is common in any household now; however, in the film, it was used for high caliber situations such as operating a spacecraft on its way to Jupiter. Therefore, while AI does exist to some degree as it did in the movie, there is still a way to go in the advancement before one such as Hal is developed.

In contrast, the film also predicted technological advancements that scientists have yet to achieve even by the year 2020. Namely, the main storyline of two scientists on their way to Jupiter is still a fantasy in the modern world (Kubrick, 1968). Today, the world's best engineers are still figuring out how to send humans to Mars and back, so the ability to send a manned spacecraft to Jupiter is still incredibly theoretical and will most likely be for years. This begs the question: with the technology engineers have been able to develop, why have space scientists not been able to achieve advancements like films such as *2001: A Space Odyssey* promised they would have by this year?

In the case of actor network theory, the actors are the film, *2001: A Space Odyssey*, the film's creators, film watchers, the public, policy makers, engineers, and advancements in technology. An illustration of this network is depicted below in figure 3.

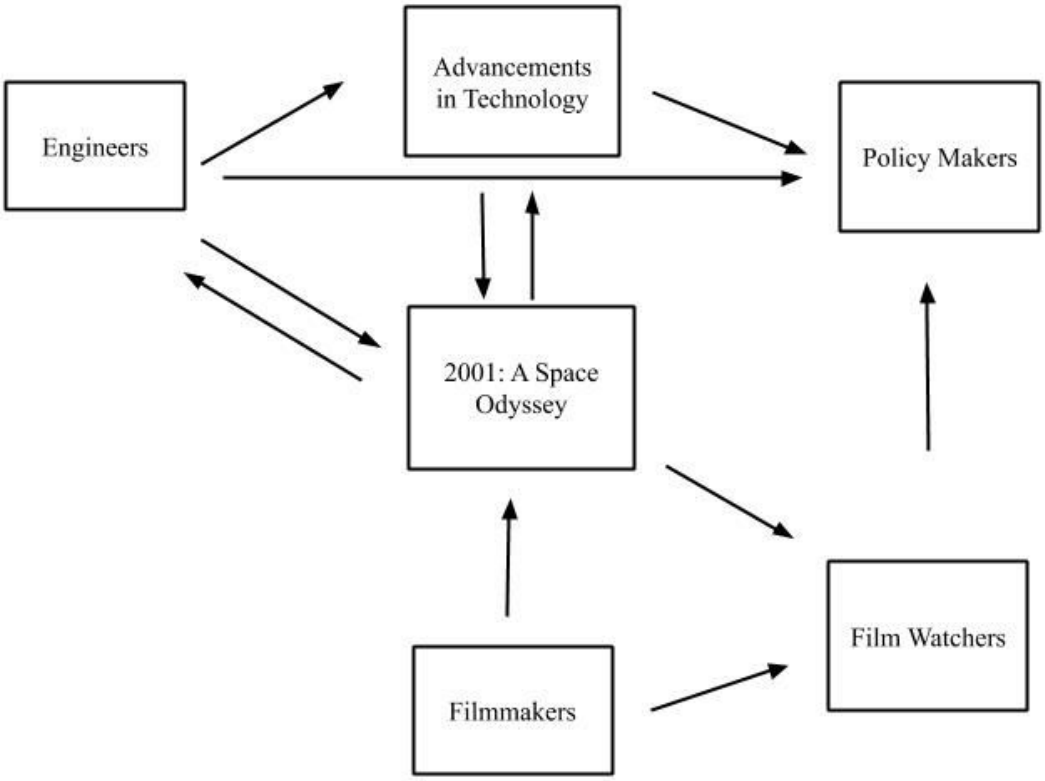

Figure 3: *STS framework*: Interaction of *2001: A Space Odyssey* and the actors it influences (Pollard, 2019)

As depicted above, the filmmakers were inspired by existing technologies and in turn, inspired engineers to develop future technologies through the film, *2001: A Space Odyssey*. These technologies include those mentioned above such as AI and an ISS. The film itself influences film watchers and policy makers. Filmmakers create new science fiction films that can inspire future engineers. Policy makers are included in order to get the whole picture on why space science has not reached the level in which Stanley Kubrick believed it would. Their influence would be on the funding available for space science research and public interest which has decreased since the space age of the 1960s. Therefore, this model highlights the negotiation

between the actors presented and their influence on each other in order to understand how the film has impacted the creation of new technologies.

The concept of Visioneers is applicable in that the writers of the film, Stanley Kubrick and Arthur C. Clarke, along with the scientists and engineers they hired to be technical consultants, are innovators of new technologies that had yet to exist at the time of the film's completion. In addition, the engineers that are constantly being influenced by this science fiction epic are visioneers because they continue to create the future everyday as they imagine and develop new and exciting technologies. These two theories along with research will be used to understand the impact of this film on the future of technological advancements.

RESEARCH METHOD AND QUESTIONS

This research project will employ published journals and articles as well as Actor Network Theory in order to discover why modern day space scientists have yet to physically explore places beyond the moon, such as Mars and Jupiter. In addition, *2001: A Space Odyssey* will be analyzed to see what technologies the film promised society by the year 2001 and see how well its predictions hold up in the year 2020. The anticipated and hoped-for outcome is that there is a correlation between the technology the film imagined and current technological advancements that exist in addition to those that are being developed, proving that art and science are not separate but instead go hand-in-hand. It is important to explore the implications of the influence of art on science as the future is undecided and is constantly being molded by the innovators and visioneers in the art and science world. Therefore, this thesis will answer the question, how has science fiction film influenced the development of new technologies and why

has space science not reached the level of advancement depicted in the film, *2001: A Space Odyssey*?

DATA SOURCES

Because the first part of this question is more up to interpretation as opposed to quantitative data and graphs, journals, articles, and some statistics were used to understand the impact of science fiction film on the development of technology. The film, *2001: A Space Odyssey*, was watched and rewatched multiple times in order to evaluate what technologies depicted in the film exist now and which ones are far from being developed. For the second question relating to why the advancement of space science has seemed to have stalled, research into funding and public interest into space exploration was conducted.

RESULTS

The similarities in design and function between the technologies that exist in *2001: A Space Odyssey* and those that exist now, years later, are too strong to deny that the film has not had any influence on the advancement of space science. HAL resembles modern day AIs used in many households today such as Amazon's Echo. The international space station depicted in the film, while not closely resembling the one constructed in the 1990s, has the same function as the one many countries around the world use now. In the case of the stall in space science research, NASA has significantly decreased the funding for space exploration and development. This has most definitely hindered the creation of new and exciting technologies like the ISS and AI. In

addition, public hype surrounding space exploration has decreased since the space age which has also impacted the advancement of space research.

Before looking into the specific technologies that exist in the film, *2001: A Space Odyssey*, that may or may not exist now, how much video based media the general population consumes was investigated. Screens are everywhere now, and people are reading less and watching television, movies, and videos now more than ever. According to figure 4 below from The Atlantic, the average individual watches about five hours of television each day while the average American household watches almost eight hours of television per day (Madrigal, 2018).

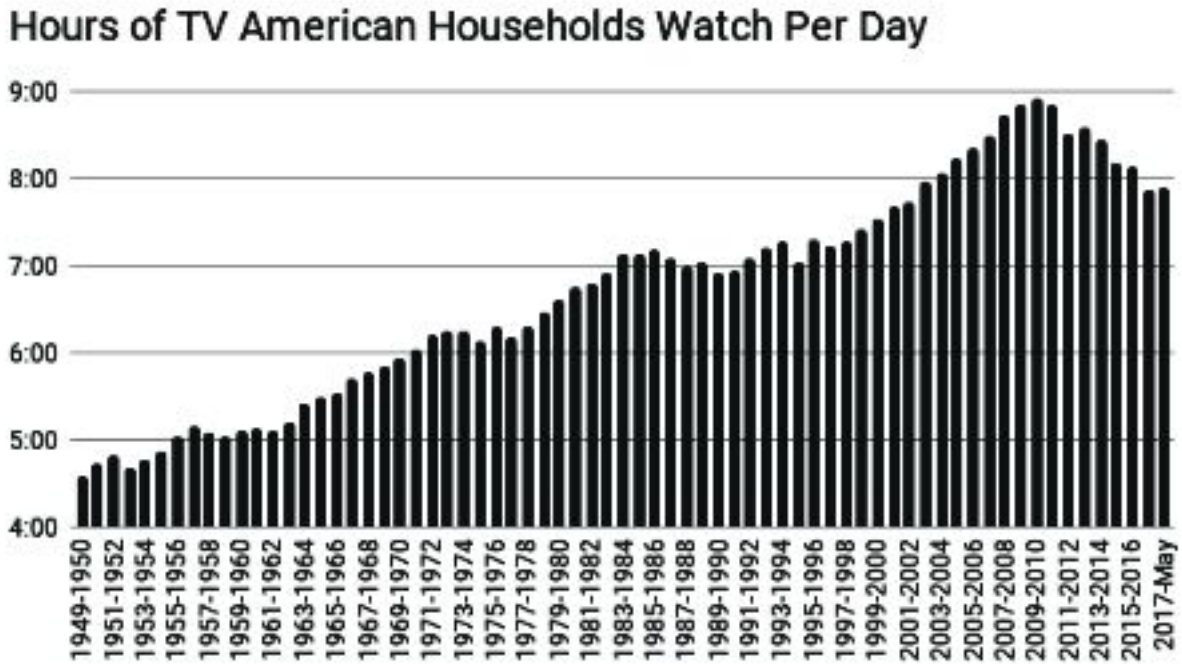

Figure 4: *Hours of TV American households watch per day* (Madrigal, 2018)

To put this into context, the average American watches television, including films, like it is a full-time job. In contrast, the average amount of time Americans spend reading is 17 minutes a day. Therefore, because there has been such an increase in the amount of video-based media

people intake, it is worth suggesting that this sort of media, science fiction films in the case of this thesis, have some influence on the way people think and what those in the world of space science create.

The film, *2001: A Space Odyssey*, came out in 1968, meaning that it has had 52 years to influence those who watch it, and many of the technological advancements in the aerospace field that seem inspired by this film suggest that. The technologies depicted in the film have almost no doubt influenced scientists to develop them themselves. Similarities between the real-life ISS and the one depicted in the film have already been discussed in detail in the case context section, but to emphasize, construction on the real-life ISS did not begin until 1998 while one of the same caliber and function was depicted in this film in 1968, thirty years prior (U.S. National Laboratory, 2019). It is impossible to deny that the film did not have some sort of influence on Ronald Reagan's decision to start construction on a similar structure.

Artificial Intelligence and its history and depiction in the film are also discussed at great lengths in the case context section. However, for comparison, figures 5 and 6 below are of the HAL in the film and Amazon's Echo, respectively, in order to see how similar the two are.

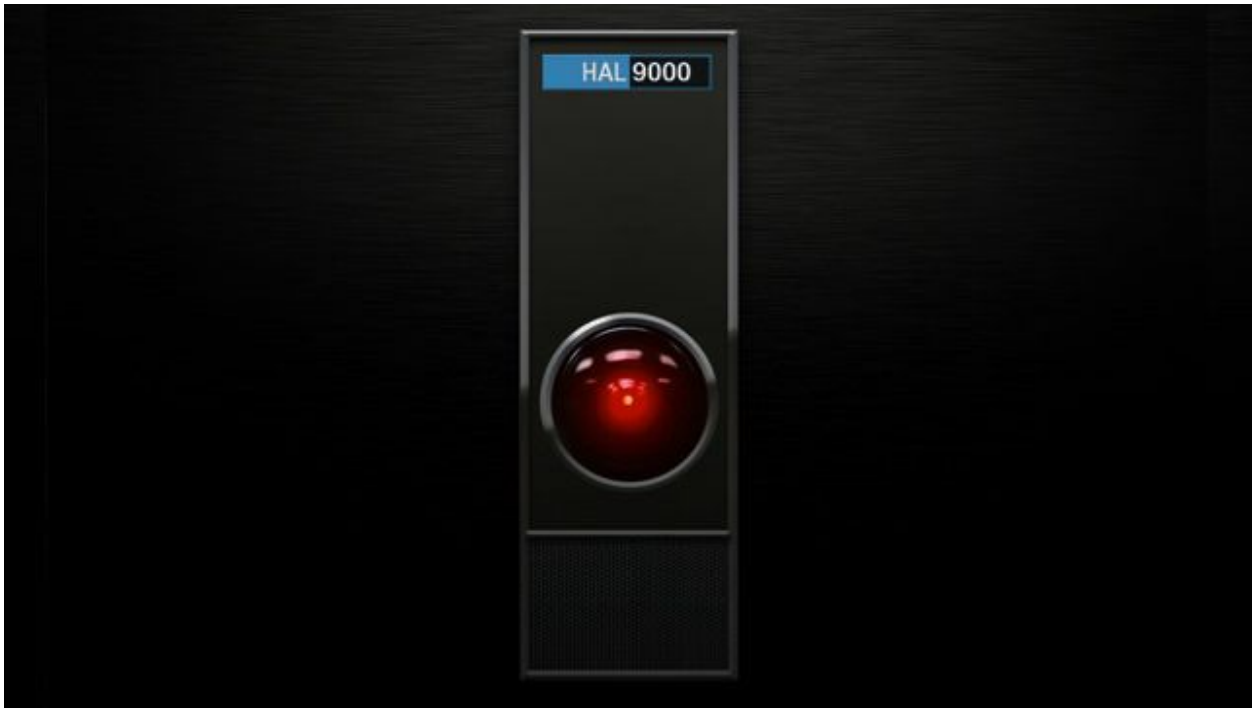

Figure 5: *HAL9000* (A.M.P.A.S., 1968)

Figure 6: *Amazon Echo Plus* (Amazon, 2019)

These two devices have similar designs with the main difference being one is cylindrical and the other rectangular. However, they both feature personal assistants with human-like personalities: Hal for the HAL 9000 and Alexa for the Amazon Echo. Personal AIs have been integrated in phones and computers such as Apple's Siri and Google Assistant, so it is difficult to believe that HAL did not have some influence on the design of Amazon's personal assistant. In fact, if you ask Alexa to "open the pod bay doors," a command Bowman gives HAL in the film, Alexa will respond with "I'm sorry, Dave. I'm afraid I can't do that. I'm not Hal, and we're not in space" (Telegraph Reporters, 2018). While in the film, HAL is responsible for operating the functions that come with flying a spacecraft all the way to Jupiter, the real-life Alexa handles more common functions such as turning lights on and off and playing music. Although, it is only a matter of time before the Alexa's of the world become more like HAL with the way AI is becoming more and more prominent in everyday life.

The second half of this thesis answers the question, why has space science not reached the level of advancement Stanley Kubrick promised it would by the year 2001, or even 2020. In order to answer this question, the trend for yearly NASA budgets was investigated. At its height in the 1960s, NASA was receiving upwards of 4.41% of the federal budget. This was 5.9 billion dollars at the time, which is equivalent to 47.4 billion dollars in 2020. Budget allocations for NASA steadily decreased after 1966 and are now around 0.48%, equivalent to about 20.8 billion dollars (Kring, n.d.). Therefore, despite having a bigger federal budget, when adjusted for inflation, NASA is receiving less than half the budget it was in the 1960s. Technological advancement of space science and exploration is impossible to achieve without a suitable budget.

In addition to lack of funding, the public's interest in space exploration has decreased since the space age of the 1960s. Going to the moon was a huge step along with being a race against the Soviet Union, so the American population was deeply invested in the development of the necessary space technology. However, with the current threat of climate change, most Americans believe NASA's top priority should be monitoring the Earth's climate rather than exploring beyond Earth. In a 2018 study conducted by the Pew Research Center, 45% of U.S. adults believe that sending astronauts to Mars is important but a low priority, and 37% believe that it is not too important and should not be done while only 18% believe that it is a top priority (Strauss, 2018). The rest of the results from this study are depicted in the graphic below.

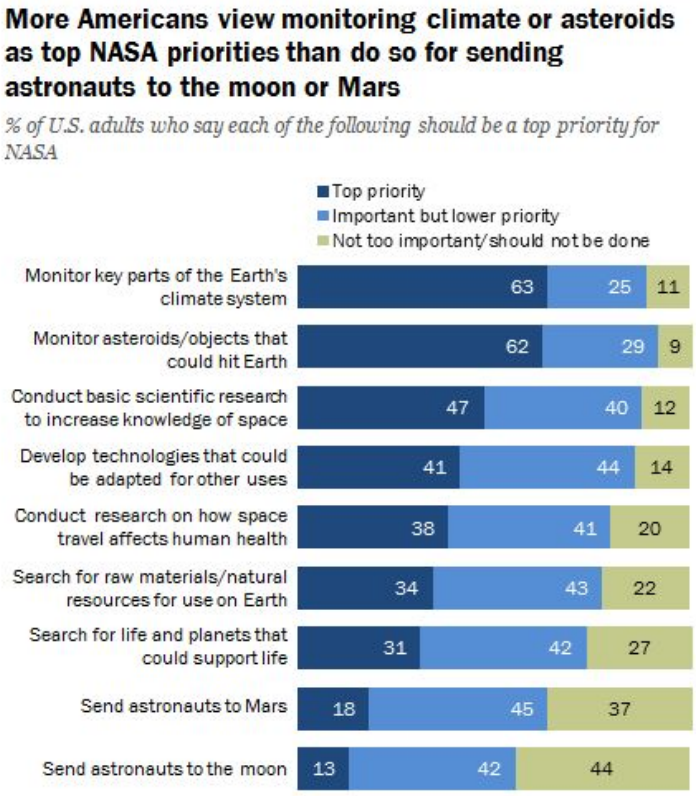

Figure 7: *More Americans view monitoring climate or asteroids as top NASA priorities than do so for sending astronauts to the moon or Mars* (Strauss, 2018)

As depicted above, Americans care more about taking care of Earth as opposed to exploring beyond it. This no doubt has impacted the funding NASA receives, as well as what they use that funding to research and develop.

DISCUSSION

The research question posed in this thesis is more up for interpretation and impossible to answer with just facts. However, the evidence found such as the technologies depicted in the film, *2001: A Space Odyssey*, and statistics relating to the public's interest in space exploration can be used in a broader context. Fictional technologies in other science fiction films, such as *The Martian* and *Interstellar*, can be investigated in the same way I did with *2001: A Space Odyssey* in relation to the fictional technologies depicted in those films.

Limitations of this research again include how it relies more on correlation and interpretation as opposed to facts and data. In addition, the film came out over fifty years ago and there are not any interviews with the technical advisors or crew who worked on the film who are now deceased. In the future, I would probably investigate more than one film or perhaps a film that is more recent, so the correlation between the technologies depicted and those that exist now is harder to refute.

While this research will probably in no way advance my engineering practice, it was interesting to see how science fiction films can influence the sort of technologies the people in my field research and develop. Engineers create the future in a sense, so it is important to investigate what influences them and how this influence helps them shape the scientific world. It would be fun to continue this research with other science fiction films and even literature.

CONCLUSION

In the current age, video-based media is everywhere. It is impossible to get away from screens as they are in public establishments, our living rooms, and even our back pockets. How we are influenced by what we watch is important to acknowledge as we continue to create our future. This concept is covered on a micro level in the scope of the film, *2001: A Space Odyssey*, but it can certainly be applied to other situations. Video-based media such as films, television, and video games no doubt influences people even subconsciously, and this can be investigated not only in the technologies we develop but the way we think, act, and live. Times are changing, and there is not a lot of time in the day in which the average person does not have a screen in front of their face, myself included. It is important to go broader and understand how this shift in information intake will impact our future.

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