

Robots, Romance, and Realism:

How Movies Shape Modern Spaceflight

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Abstract

With companies advertising vacations to space, interstellar tourism is becoming more feasible in the 21st century. This research explored the depiction of human health in science fiction films to question the timeline of space tourism. By utilizing various resources such as NASA, MedlinePlus, and PubMed, this research was able to examine the human health issues in WALL-E, The Space Between Us, and The Martian. Results illustrated that the following movies were very unrealistic in their demonstration of space medicine. The fantasy of these films not only explains the lack of information humanity has on human health in space, but also creates interest for corporations to unveil a new market. If space tourism is to begin in the next decade, further research on long-term implications of space exploration needs to be conducted before civilians are launched into orbit.

Introduction

Beginning in 1902 with *Le Voyage dans la Lune* by Georges Méliès, people have been fascinated by the idea of humans traveling through space. The public's love for sci-fi only grew as time progressed, ranging from the cult following of *Star Wars* to the worldwide theories of *Interstellar*. With this growing fascination with space films, people want nothing more than to see it with their own eyes: the magic of outer space. While there is some enchantment in this fantasy, space enthusiasts also need to realize what can happen to the health of their bodies while they are "beaming" to every planet they can find.

There are many hazards of space exploration. For example, the degradation of eyesight in space; unknown to the average tourist, but imperative for astronauts. Neuro-ocular Syndrome occurs due to intracranial pressure and causes loss in vision and increased blind spots in long-term spaceflight¹. Another risk of interplanetary travel: the worrying amounts of radiation entering the human body while suspended in space. These are only two small examples of short-term spaceflight, with much remaining unknown on the impact of spaceflight over generations. With companies like Virgin Galactic, SpaceX, and Sierra Nevada trying to capitalize on this newfound space economy, health issues like those listed will begin to appear in everyday civilians².

¹ Stenger et. al, "Risk of Spaceflight Associated Neuro-ocular Syndrome," NASA, November 30, 2017.

² Neel V. Patel, "The space tourism we were promised is finally here – sort of," MIT Technology Review, February 3, 2021, <https://www.technologyreview.com/2021/02/03/1017255/space-tourism-finally-here-sort-of-spacex-inspiration4/>.

Keeping all of this in mind, is human space tourism really ethical? Will humans, being impatient, refrain from reading all the terms, conditions, and risks before signing their name on the dotted line? By analyzing the movies average consumers watch through a medical lens, the information regarding what people believe to be true about space medicine can be demystified. This research paper aimed to ask the question; how do science fiction movies portray the endless health problems that derive from space travel, and what do they explain about humanity's journey to space tourism? To answer this question, this research paper will analyze three movies: *WALL-E*, *The Space Between Us*, and *The Martian*.

All movies were chosen based on the genre of space film they portray – robots, romance, and realism – and if they use medical problems or extraterrestrial changes in human physiology as a part of the narrative. For example, the loss of bone density seen in *WALL-E*. This instance, as well as many others, were scrutinized to discover if the changes in physiology were valid or invalid. The movies were not only chosen because of their depiction of humans traveling to and from space, but also due to their popularity. *The Martian* made 630.2 million dollars at the box office at its release in 2015; subsequently, *WALL-E* made 523.3 million in 2008, and *The Space Between Us* made the least at 16.08 million in 2017. Millions of people have seen these movies and have likely been influenced by them. The process for research in this paper included a brief synopsis of each movie and a review of various NASA webpages and health resources to interpret the false health information in the films. After the completion of this process, ethical concerns for space tourism were explained.

Literature Review

The literature in this research paper utilized both primary and secondary sources to support the conclusion. All sources in this literature review served the greater topic of ethics and

human or robot space settlement on Mars. Sources ranged from books to academic articles to online interviews. Human health references included; journal articles, NASA books, NASA articles, and various government websites and resources. A wide range of resources were used to ensure both spaceflight and earthly medical conditions were studied.

Science fiction films carry great importance for the creativity found in modern-day space fans. In “The Impact of Science Fiction Film on Student Understanding of Science,” Anderson et al. explored the idea that science fiction could mold the development of new ideas and understandings regarding science fiction films. Specifically, the film, *The Core* was used to verify students’ knowledge of geophysics. The students took what the characters claimed as truth; the authors state, “...a film’s attention to scientific detail appears necessary to root a plot or idea in reality but it appears that the plausibility of those ideas has significant potential to influence students’ ideas about scientific concepts.”³ When compared to the movies studied in this research project, the principles were similar. The inspiration created from these fantastic science-fiction movies provide expectations for the future, for better or worse.

Imagination has always been an important, yet dangerous, factor of space travel. In *Space and The American Imagination*, Howard E. McCurdy discussed how this creativity contributed to space policy and how the public perceived that goal. Many popular franchises during the height of the Apollo program, such as *Star Wars* and *Star Trek*, contributed to the glorification of space exploration. The simplicity of the *Millennium Falcon* “...represents the ultimate fantasy of aerospace pioneers – a personally accessible spacecraft that is relatively easy to operate and

³ Michael Barnett et al., “The Impact of Science Fiction Film on Student Understanding of Science,” *Journal of Science Education and Technology* 15, no. 2 (August 25, 2006): 179–91, <https://doi.org/10.1007/s10956-006-9001-y>.

maintain.”⁴ To science fiction enthusiasts, the ease of extraterrestrial travel seemed like a dream. The laws of physics and the unforgiving environment of space were justified by the guise of Hollywood. Tourists consumed this media and wished to defy the laws of physics themselves, which then romanticizes the danger of the “...spacefaring dream – cheap, reliable, frequent access to space.”⁵ The problem with this notion is not the goal of getting to space but the lack of knowledge. Space travel is not effortless, and movies illustrated astronauts as “...suffer[ing] few ill effects, under[going] little preparation, and encounter[ing] modest risk,”⁶ without realizing the implications of that portrayal.

These sci-fi films hold power in humanity’s desire for extraterrestrial flight. This communal love for space has been influenced by the development of space tourism and the announcements of various companies entering the market, including Blue Origin, Virgin Galactic, and SpaceX. Corporations such as these procure images and descriptions of life in space, further creating excitement for the future. As discussed in Melvin Stephen Marsh’s, “Ethical and medical dilemmas of space tourism,” space tourism is an exciting prospect, but the human implications of that step will need to be debated as civilization develops its place in space. Medical implications for long vacations on extraterrestrial bodies could be damaging. “[V]isitors to the Moon run the risk of never being able to return to what will feel like the crushing gravity of Earth,” in fact, “Nothing, absolutely nothing is known about the long-term

⁴ Howard E McCurdy, *Space and the American Imagination* (Baltimore, Md.: Johns Hopkins University Press, 2011).

⁵ McCurdy, *Space and the American Imagination*, 273.

⁶ Ibid, 208.

effects of partial Earth gravity.”⁷ Not only is there risk seen with regular medical implications such as bone density and immune suppression, but risk seen in everyday medical practices like prescription drugs⁸. If spaceflight does become normalized, then many physicians will have to have a basic understanding of how conditions and drugs will react in microgravity. As humanity learns more about the human body in space, plans will have to be made regarding passenger aftercare and the education of existing and future physicians on space medicine.

Former astronauts have discussed the medical implications of space flight and exploration, and even testified against the lack of extended care for those returning to Earth from extraterrestrial biomes. Dr. Richard Williams, the chief medical professional at NASA, proposed legislation for annual medical check-ups for former astronauts. Dr. Jeffrey Kahn stated in the same hearing, “Our committee concluded that the ethical responsibilities that result from sanctioning high-risk activities include continuous learning and engagement in health-related activities that protect astronaut health, support ongoing evaluation of health standards, improve mission safety, and reduce risks for current and future astronauts.”⁹ The hearing concluded with improved monitoring for former astronauts, but the ethics were still open-ended. In terms of Melvin Stephen Marsh’s discussion on space tourism, will people have intensive examinations before and after vacations? There is much to be considered and questioned in such a novel field.

⁷ Christopher Wanjek, *Spacefarers : How Humans Will Settle the Moon, Mars, and Beyond* (Cambridge, Massachusetts: Harvard University Press, 2020), 193.

⁸ Melvin Stephen Marsh, “Ethical and Medical Dilemmas of Space Tourism,” *Advances in Space Research* 37, no. 9 (January 2006): 1823–27, <https://doi.org/10.1016/j.asr.2006.03.001>.

⁹ *Human Spaceflight Ethics and Obligations: Options for Monitoring, Diagnosing, and Treating Former Astronauts*, 114th Cong. (2016) (statement of Jeffrey Kahn, Professor of Bioethics and Public Policy).

Astronaut care is essential to successful space travel, and the policy for tourist post-flight care will need to be extensive to prevent serious health conditions. The dialogue in this hearing will be interesting to consider in terms of the practices performed in all the films.

If the health risks are so significant, is it plausible to even go at all? It is up for debate, but the general answer is yes. According to Gwen Bradford in her presentation, “Is there a moral obligation to go to Mars?,” humans do have a moral obligation to go to Mars. The slight one-in-a-million chance of intelligent life occurring on Earth transpired, so there is a need to preserve the good.¹⁰ To further prosper and continue intelligent life is continuing the good for the future of humanity. While Bradford’s talk assumed Mars would be a substitute for Earth, this research applied Bradford’s conclusion through Christopher Wanjek’s belief that going to Mars is not a “plan B”¹¹ for Earth. Rather, sending humans to Mars, either for leisure or science, further promotes the human species and preserves the good. Therefore, it would be beneficial for humans to settle on other planets, but the medical implications may outweigh this moral obligation.

Analysis

WALL-E

WALL-E was a Pixar film released to the public in 2008¹². It is an animated film regarding the irresponsibility of humanity and the importance of taking care of the environment.

¹⁰ Lone Star College-Kingwood, “Curious Minds: Is There a Moral Obligation to Go to Mars? - Presented by Gwen Bradford,” *YouTube*, November 1, 2019, <https://www.youtube.com/watch?v=w4iaAONU7u4>.

¹¹ Wanjek, *Spacefarers: How Humans Will Settle the Moon, Mars, and Beyond*, 344.

¹² Andrew Stanton, *WALL-E* (2008; Los Angeles, CA: Disney, 2008), Disney+.

The movie follows WALL-E (Waste Allocation Load Lifter – Earth Class), the small square robot who was programmed to clean up abandoned garbage, and EVE (Extraterrestrial Vegetation Evaluator), the robot from “the Axiom” tasked with finding signs of life on Earth. WALL-E and EVE find a plant on Earth and return to the Axiom spaceship where the previous inhabitants of Earth reside. The humans on the Axiom are immobile and they move around in floating chairs - living their lives through screens, augmented reality, and simulations. WALL-E and EVE proceed through a series of events to deliver the plant to the captain to save the future of Earth and its citizens. *WALL-E*’s message conveys environmental consciousness, the danger of corporations, and human dependence on technology.

The most apparent medical issue in *WALL-E* was the loss of bone density seen in the humans. The audience was shown pictures of previous captains of the Axiom; as the camera pans, the captains get noticeably larger and stationary. The population was fed liquid food in cups, kept mobile with floating chairs, and consumed by projection screens. When in low gravity situations, bone density is diminished¹³. According to the late president in the film, “Due to the effects of microgravity, you and your passengers might have suffered some...slight bone loss.”¹⁴ The medical term for bone loss due to a lack of stressors is called disuse osteoporosis. This condition is often seen in astronauts, so it is the most reasonable justification for the humans’ immobility in *WALL-E*.

¹³ “NASA - Bones in Space,” Nasa.gov, 2009, https://www.nasa.gov/audience/foreducators/postsecondary/features/F_Bones_in_Space.html.

¹⁴ Stanton, *WALL-E*

While there was a loss of bone mass, what about the large size of the passengers? In the film, every human seen living on the Axiom suffers from extreme obesity. Disuse osteoporosis does not cause obesity; in fact, increased bone mass is correlated with obesity¹⁵. The obesity seen in *WALL-E* is likely a result of the food served on the Axiom. When the captain of The Axiom performs morning announcements, he proclaims, “Today’s special is, cupcake in a cup!”¹⁶ When observing the state of the passengers, the obesity seems to derive from the dependence on technology; they took what they were provided from the ship. This muscle and bone loss could have been counteracted with exercise. Astronauts on the ISS are required to exercise “2.5 hours a day for 6 days a week”¹⁷ to prevent excessive bone loss. While this might have helped them, to an extent, the astronauts on the ISS spend about a year on the space station, not 700 years.

The most incorrect scene of the film was when the future humans were able to stand after returning to Earth. If they were unable to stand in microgravity, would they be able to hold their weight on Earth’s gravity? The theoretical answer would be no. According to the visual the film displays, although cartoonish, they have very little bone mass. Another scene where this was portrayed was when a passenger fell off his hoverchair and was unable to stand. The babies were even in floating vehicles, so it is unlikely that they had ever even walked before. According to

¹⁵ Lan-Juan Zhao et al., “Relationship of Obesity with Osteoporosis,” *The Journal of Clinical Endocrinology & Metabolism* 92, no. 5 (May 2007): 1640–46, <https://doi.org/10.1210/jc.2006-0572>.

¹⁶ Stanton, *WALL-E*.

¹⁷ Jancy C Mcphee, John B Charles, and United States. National Aeronautics And Space Administration, *Human Health and Performance Risks of Space Exploration Missions : Evidence Reviewed by the NASA Human Research Program* (Houston, Tex.: National Aeronautics And Space Administration, Lyndon B. Johnson Space Center ; Washington, D.C, 2009).

the information previously discussed on the amount of exercise needed to sustain bone and muscle in short-term space flight, standing in 1G would be doubtful.

The only concern regarding this argument would be the guise of gravity shown within the Axiom. The humans fell, and they were able to drop items, making it seem as if they were not suspended in microgravity but artificial gravity. This research followed the information the film explicitly states in the exposition; that the passengers of the Axiom were suspended in microgravity.

The Space Between Us

The Space Between Us was a sci-fi romance film released in 2017¹⁸. The story follows a sixteen-year-old boy named Gardner born on Mars who dreams of life on Earth. Gardner was monitored closely by scientists, government officials, and his guardian, Kendra, while being kept secret from the rest of the world. When NASA finally allows him to visit Earth, he escapes the government facility where he was detained in pursuit of his father. Gardner meets up with Tulsa, his online love interest, to travel across the United States together. Throughout the trip, Gardner was implied to have worsening health conditions. At the climax of the movie, Gardner arrives at his father's house to find out that the scientist monitoring him, Nathaniel, was his father all along. Nathaniel pilots a spaceship to get Gardner back into microgravity. 0G healed his condition, and it was assumed that Gardner flew back to Mars. To conclude the film, the audience was shown Tulsa training to be an astronaut on the Mars base.

¹⁸ Peter Chelsom, *The Space Between Us* (Burbank: STXfilms, 2017), Netflix.

Gardner's mother conceived him right before launching for Mars. Therefore, Gardner developed in microgravity and was born right after Gardner's mother and her team landed at the Mars base. There are so many concerns associated with fetal development in space including, "...environmental factors such as low gravity and the presence of cosmic radiation...",¹⁹ There is not much information on the development of fetuses in microgravity because the reality of that concept is so distant. To date, the only account of pregnancy in microgravity was an experiment performed in 1982 on ten pregnant rats²⁰. The primary issue observed in the pups were inner-ear problems, that affected their balance and mobility development²¹. Gardner's mother conceived him on Earth and carried him on the journey to Mars. This means there was a possibility he would have suffered from damaging birth defects. This assessment can only be based on the current research findings, confirming the amount of existing information that humanity presently lacks. Gardner grew up in the Martian atmosphere, so theoretically, his body could have changed to compensate for the new Martian environment. The lack of light would cause changes in skull structure, eye size, and skin color; with eyes enlarging and skin color either becoming lighter or darker. These are only hypotheses; the true effect of Mars on the human body is ultimately unknown at this time.²²

¹⁹ Haley Schuster and Steven L. Peck, "Mars Ain't the Kind of Place to Raise Your Kid: Ethical Implications of Pregnancy on Missions to Colonize Other Planets," *Life Sciences, Society and Policy* 12, no. 1 (August 25, 2016), <https://doi.org/10.1186/s40504-016-0043-5>.

²⁰ April E. Ronca et al., "Effects of Microgravity on Vestibular Development and Function in Rats: Genetics and Environment," *Korean Journal of Biological Sciences* 4, no. 3 (January 2000): 215–21, <https://doi.org/10.1080/12265071.2000.9647547>.

²¹ Ibid, 215.

²² Wanjek, *Spacefarers: How Humans Will Settle the Moon, Mars, and Beyond*, 294.

Before Gardner was permitted to visit Earth for the first time, he was required to undergo surgery to increase his bone density. This surgery gave him “carbon nanotubes” on the bones in his forearms and calves; which, with exercise, would allow him to walk in 1G. As farfetched as it may seem, carbon nanotubes have been used in regenerative medicine and are being considered as a treatment for osteoporosis²³. There has been little research on the medical use of carbon nanotubes in space; the closest dialogue on carbon nanotubes regarded production and constructional use in microgravity. Furthermore, there could be hazards found in the toxicity of carbon nanotubes in the human body, “CNTs [carbon nanotubes] are considered to have carcinogenicity and can cause lung tumors...”²⁴ The carcinogenicity of the carbon nanotubes was dependent on the length: shorter the fiber, more minor the threat. The fibers depicted in the film seemed to be shorter, but there could still be a risk for future conditions. Gardner was born on Mars and spent 16 years living within .375 of Earth’s gravity. At this moment in time, no human has been on Mars, much less spent 16 years in space. With that said, it is unlikely that Gardner would be able to exercise for a few weeks, after previous signs of inactivity, and be strong enough to stand and walk on Earth directly after landing.

The most explicit medical issue seen in this film is the ambiguous coughing Gardner suffers with throughout his time on Earth. The audience later finds out that this coughing is because he has an enlarged heart (cardiomegaly) due to the strain of Earth’s gravity. After the audience was shown signs of a problem, Gardner’s blood tests revealed high levels of Troponin.

²³ Manabu Tanaka et al., “Applications of Carbon Nanotubes in Bone Regenerative Medicine,” *Nanomaterials* 10, no. 4 (April 2, 2020): 659, <https://doi.org/10.3390/nano10040659>.

²⁴ Norihiro Kobayashi, Hiroto Izumi, and Yasuo Morimoto, “Review of Toxicity Studies of Carbon Nanotubes,” *Journal of Occupational Health* 59, no. 5 (2017): 394–407, <https://doi.org/10.1539/joh.17-0089-ra>.

Troponin is a protein found in the heart and is only released into the bloodstream when the heart is damaged, which occurred in *The Space Between Us*²⁵. When Gardner is seen suffering from cardiomegaly, he was immediately taken into microgravity to improve his condition. This automatic change in position could be an appropriate treatment. “On return to Earth, gravity once again “pulls” the blood and fluids into the abdomen and legs. The loss of blood volume, combined with atrophy of the heart and blood vessels that can occur in space, reduces the ability to regulate a drop in blood pressure that happens when we stand on Earth. Some astronauts experience orthostatic intolerance – difficulty or inability to stand as a result of light headedness and/or fainting after return to Earth.”²⁶ Those were the symptoms Gardner demonstrated, so a rapid trip to microgravity could have potentially treated the issue.

The Martian

The Martian was a film released in 2015 set in the year 2035 when humanity has achieved landing on Mars. The film follows an astronaut on Mars named Mark Watney, who was stranded after being blown away during an intense dust storm at the opening of the movie. In order to survive, Mark has to use leftover technology, his botany skills, and scientific creativity to survive 564 days on the Martian surface. Back on Earth, NASA officials were working towards getting Mark home, but the outlook was worrying. Eventually, they decide to wait until the next trip to retrieve Watney, but the crew of the Hermes received plans on a way to rescue

²⁵ “MedlinePlus: Medical Tests,” Medlineplus.gov, 2019, <https://medlineplus.gov/lab-tests/>.

²⁶ Michael Johnson, “Cardiovascular Health in Microgravity,” NASA, January 7, 2020, https://www.nasa.gov/mission_pages/station/research/station-science-101/cardiovascular-health-in-microgravity/.

Watney safely by using Earth's orbit. Bypassing the advisement of NASA, they successfully save him from the incident and return Mark home safely²⁷.

One of the first scenes shown to the audience in *The Martian* was the intense dust storm that propelled Mark away from the rest of his crew. Most likely, this dust storm would not blow an astronaut away; but the fear for the equipment was hypothetically valid. NASA debunked *The Martian* themselves, claiming, "The winds in the largest dust storms likely could not tip or rip apart major mechanical equipment. The winds in the strongest Martian storms top out at about 60 miles per hour, less than half the speed of some hurricane-force winds on Earth."²⁸ The concern about the dust storms is not being blown away, but the dangers within the dust itself. Martian dust is not only small and dangerous to soft tissue, but also toxic; "[s]ome material on Mars may be carcinogenic (known to cause cancer) ..."²⁹ Even though the carcinogenic nature of Martian dust has yet to be confirmed, Mark showed no signs of any dust entering his lungs, or his habitat, at all. The movie was aware of the dust; the audience was shown Mark Watney clearing the dust off the solar panels. Mark brought dust inside his habitat and tended the potatoes without any face covering or helmet, so he would inevitably breathe the Martian dust into his lungs and cause injury.

Another topic reviewed was artificial gravity. The fictional ship, *Hermes*, in *The Martian* was said to have artificial gravity. Described as, "a hundred-meter-long tube with a central

²⁷ Ridley Scott, *The Martian* (Los Angeles: 20th Century Fox, 2015), Hulu.

²⁸ Kathryn Mersmann, "The Fact and Fiction of Martian Dust Storms," NASA, 2011, <https://www.nasa.gov/feature/goddard/the-fact-and-fiction-of-martian-dust-storms>.

²⁹ "MEPAG," Nasa.gov, 2019, <https://mepag.jpl.nasa.gov/goal.cfm?goal=5>.

rotating hub that's shaped like a Ferris wheel,"³⁰ the *Hermes* spacecraft looked like a luxury apartment complex. Several rotating amenities were included, along with the areas of microgravity where passengers could float to each facility. Within the facilities, passengers seemed to be under the influence of artificial gravity. Animal studies have shown positive effects of artificial gravity in preventing bone loss, but human studies remain limited. The rodents studied, "...demonstrated...that the development of microgravity-induced osteoporosis and concomitant decreases in bone structural properties and strength could be mitigated by hyper gravity produced by centrifugation."³¹ The *Hermes* ship, although fantastical, used centrifugation to create artificial gravity. Even though there is a lack of studies involving humans on artificial gravity, in theory, it should have no adverse effects on passengers.

The final topic was the potatoes Mark farmed during his time on Mars. This was fascinating to watch; seeing a human use Martian soil and fertilizer to grow Earthly crops created hope that potatoes could be grown on Mars. As great as this could be, Martian soil does not have the automatic capabilities to cultivate crops like Earthly soil does. Not only has plain Martian soil been shown to be toxic, but a human would not gain enough nutrients through potatoes to keep them healthy for four years. "Within a year Watney would have developed a host of symptoms: night blindness from lack of vitamin A, rickets from lack of vitamin D, nerve damage from lack of vitamin E, easy bruising from lack of vitamin K, weak bones from lack of calcium, and a weak heart and deadly Keshan disease from lack of selenium. Also, potatoes have nearly

³⁰ Wanjek, *Spacefarers: How Humans Will Settle the Moon, Mars, and Beyond*, 236.

³¹ Janis Davis-Street and William H. Paloski, "Artificial Gravity: Will it Preserve Bone Health on Long-Duration Missions?" NASA, (2005).

no fat, another essential nutrient.”³² So, potatoes would not have endured in the Martian environment or sustained in the human body. The biggest fear would be that Mars would be unable to grow any organic material due to the toxic chemicals found in the soil. “There may not be the right amount of nutrients depending on where astronauts land on the Red Planet, so fertilizers may need to be added to the soil. The perchlorates in the soil would be leached out and separated from the water.”³³ Hope remains for farming on Mars, but the effects of Martian gasses, plants, and possible microbes on the plants are largely unknown.

Ethics

By the alarming number of times ‘could,’ appeared in this research paper, it is accurate to say humanity has very little data on the medical consequences of space travel. It is impossible to know what will happen until humans spend long-term time in microgravity. Tourism is the future of space exploration – the next step for normalizing space travel. The primary concern for businesses is proceeding into the future morally, but fortunately, the past can suggest a positive future for both passengers and organizations.

This section was held under two assumptions: that corporations will be the primary party to conduct space tourism and that the beginnings of space tourism will occur in the expected timeline (2022-2023)³⁴.

³² Wanjek, *Spacefarers: How Humans Will Settle the Moon, Mars, and Beyond*, 264.

³³ Gary Jordan, “Can Plants Grow with Mars Soil?,” NASA, 2011, <https://www.nasa.gov/feature/can-plants-grow-with-mars-soil>.

³⁴ Neel V. Patel, “The Space Tourism We Were Promised Is Finally Here—Sort Of,” MIT Technology Review, February 3, 2021, <https://www.technologyreview.com/2021/02/03/1017255/space-tourism-finally-here-sort-of-spacex-inspiration4/>.

As exciting as space tourism will be, the primary goal for these companies is to make money from commercial space flights. Opening up space flight as an industry incites employment, investment, and, most importantly – interest.³⁵ Interest causes both investors and passengers to contemplate participating in the new space age. While exciting, this developing market does not come without ethical implications. Applying Kantian philosophy to business ethics relays that to be a reasonable business is to maintain morals. In terms of space flight, “Human being is always [an] end and not means.”³⁶ Using humans as ‘instruments,’ to create interest inherently violates Kant’s humanity formula. To ethically send visitors to space, corporations need to be certain that it is the right time. Launching humans to vacation in microgravity too early in extraterrestrial advancement is using them for the needs of corporations, which, according to Kant, is immoral. Similarly, the application of Aristotle’s philosophy translates into, “[people count] more than profits...”³⁷ Jeopardizing passengers’ health for the pursuit of a new market, according to Kant and Aristotle, is not ethical. It is not moral to send humans prematurely into space to create interest, but unfortunately, maintaining patience does not seem to be an option. The ethics of the situation relies on the beholder, so it is unlikely that companies involved in space tourism will completely weigh the importance of human life without thinking monetarily.

³⁵ Patrick Collins and Adriano Autino, “What the Growth of a Space Tourism Industry Could Contribute to Employment, Economic Growth, Environmental Protection, Education, Culture and World Peace,” *Acta Astronautica* 66, no. 11 (June 1, 2010): 1553–62, <https://doi.org/10.1016/j.actaastro.2009.09.012>.

³⁶ Jernej Belak and Mateja Pevec Rozman, “Business Ethics from Aristotle, Kant and Mill’s Perspective,” ed. Desheng Dash Wu, *Kybernetes* 41, no. 10 (October 12, 2012): 1607–24, <https://doi.org/10.1108/03684921211276783>.

³⁷ Ibid, 1614.

Conclusion

There were a few limitations to this research. These films were set in the future. It is unknown what kind of technology, health support, or limitations to space travel humanity will possess in the futures presented throughout the films. During this entire investigation, the information was held under the research understood presently. Additionally, by the time space tourism comes to fruition, NASA may have significantly more knowledge, preventative measures, and solutions for these health conditions to allow the average person to experience space for themselves.

From realistic to romantic, science fiction films create many unrealistic expectations for the average enthusiast. If future tourists are not informed about every perspective of space travel, those expectations could potentially put them in danger. Currently, *The Space Between Us*, *WALL-E*, and even *The Martian* are unrealistic depictions of space exploration. Tourists consume this media and glorify the ‘ease’ of space exploration. This research is not arguing for realism in space media but the significance of medical research in space. Luckily, organizations are working on health research with NASA’s Human Research Program and various educational institutions like Baylor College of Medicine’s aerospace medicine program.

Space tourism is becoming more real as the years go on. When it does occur, a whole universe of opportunities will be accessible for millions of people. This opportunity will have to include corporations taking responsibility and certifying the health effects will not affect the enjoyment of low gravity. There will be a long journey before space tourism occurs, but the future looks bright.

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