2024

AP® Research Academic Paper

Sample Student Responses and Scoring Commentary

Inside:

Sample C

- ☑ **Scoring Guidelines**
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Academic Paper — 5 Points

Score of 1 **Report on Existing Knowledge**	Score of 2 **Report on Existing Knowledge with Simplistic Use of a Research Method**	Score of 3 **Ineffectual Argument for a New Understanding**	Score of 4 **Well-Supported, Articulate Argument Conveying a New Understanding**	Score of 5 **Rich Analysis of a New Understanding Addressing a Gap in the Research Base**
• Presents an overly broad topic of inquiry.	• Presents a topic of inquiry with narrowing scope or focus, that is NOT carried through either in the method or in the overall line of reasoning.	• Carries the focus or scope of a topic of inquiry through the method **AND** overall line of reasoning, even though the focus or scope might still be narrowing.	• Focuses a topic of inquiry with clear and narrow parameters, which are addressed through the method and the conclusion.	• Focuses a topic of inquiry with clear and narrow parameters, which are addressed through the method and the conclusion.
• Situates a topic of inquiry within a single perspective derived from scholarly works **OR** through a variety of perspectives derived from mostly non-scholarly works.	• Situates a topic of inquiry within a single perspective derived from scholarly works **OR** through a variety of perspectives derived from mostly non-scholarly works.	• Situates a topic of inquiry within relevant scholarly works of varying perspectives, although connections to some works may be unclear	• Explicitly connects a topic of inquiry to relevant scholarly works of varying perspectives **AND** logically explains how the topic of inquiry addresses a gap.	• Explicitly connects a topic of inquiry to relevant scholarly works of varying perspectives **AND** logically explains how the topic of inquiry addresses a gap.
• Describes a search and report process.	• Describes a nonreplicable research method **OR** provides an oversimplified description of a method, with questionable alignment to the purpose of the inquiry.	• Describes a reasonably replicable research method, with questionable alignment to the purpose of the inquiry.	• Logically defends the alignment of a detailed, replicable research method to the purpose of the inquiry	• Logically defends the alignment of a detailed, replicable research method to the purpose of the inquiry.
• Summarizes or reports existing knowledge in the field of understanding pertaining to the topic of inquiry.	• Summarizes or reports existing knowledge in the field of understanding pertaining to the topic of inquiry.	• Conveys a new understanding or conclusion, with an underdeveloped line of reasoning **OR** insufficient evidence.	• Supports a new understanding or conclusion through a logically organized line of reasoning **AND** sufficient evidence. The limitations and/or implications, if present, of the new understanding or conclusion are oversimplified.	• Justifies a new understanding or conclusion through a logical progression of inquiry choices, sufficient evidence, explanation of the limitations of the conclusion, and an explanation of the implications to the community of practice.
• Generally communicates the student's ideas, although errors in grammar, discipline-specific style, and organization distract or confuse the reader.	• Generally communicates the student's ideas, although errors in grammar, discipline-specific style, and organization distract or confuse the reader.	• Competently communicates the student's ideas, although there may be some errors in grammar, discipline-specific style, and organization.	• Competently communicates the student's ideas, although there may be some errors in grammar, discipline-specific style, and organization.	• Enhances the communication of the student's ideas through organization, use of design elements, conventions of grammar, style, mechanics, and word precision, with few to no errors.
• Cites **AND/OR** attributes sources (in bibliography/ works cited and/or intext), with multiple errors and/or an inconsistent use of a discipline specific style.	• Cites **AND/OR** attributes sources (in bibliography/ works cited and/or intext), with multiple errors and/or an inconsistent use of a discipline specific style.	• Cites **AND** attributes sources, using a discipline-specific style (in both bibliography/works cited **AND** intext), with few errors or inconsistencies.	• Cites **AND** attributes sources, with a consistent use of an appropriate discipline-specific style (in both bibliography/works cited **AND** intext), with few to no errors.	• Cites **AND** attributes sources, with a consistent use of an appropriate discipline-specific style (in both bibliography/works cited **AND** intext), with few to no errors.

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Academic Paper

Overview

This performance task was intended to assess students' ability to conduct scholarly and responsible research and develop an evidence-based argument that clearly communicates a conclusion or new understanding stemming from a clearly articulated research question or project goal. More specifically, this performance task was intended to assess students' ability to:

- Generate a focused research question that is situated within or connected to a larger scholarly context or community;
- Explore relationships between and among multiple works representing multiple perspectives within the scholarly literature related to the topic of inquiry;
- Articulate what approach, method, or process they have chosen to use to address their research question, why they have chosen that approach to answering their question, and how they employed it;
- Develop and present their own argument, conclusion, or new understanding while acknowledging its limitations and discussing its implications to a larger community of practice;
- Support their conclusion through the compilation, use, and synthesis of relevant and significant evidence generated by their research;
- Use organizational and design elements to effectively convey the paper's message;
- Consistently and accurately cite, attribute, and integrate the knowledge and work of others, while distinguishing between the student's voice and that of others;
- Generate a paper in which word choice and syntax enhance communication by adhering to established conventions of grammar, usage, and mechanics.

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Science Fiction and Career Aspiration

April 30, 2024

Word count: 4,857

Introduction

Space has long been of interest to the general public. Sprouting from the space race between the United States and the Soviet Union, space exploration has been portrayed to the public as an adventurous and explorative venture. Because of space's attraction, entertainment industries have leveraged the intrigue and wonder of space exploration to create immersive experiences for visitors. This wonder has been captured through rides, such as Disney's Space Mountain and Mission: SPACE, but also through different attractions, shows, and merchandise that capture the imagination and fascination that people have with space. As space as an idea became popular, shows and movies featuring the realm did as well. Science fiction films began to craft narratives and experiences that deeply connect with audiences' aspirations, dreams, and curiosities about the cosmos.

Consequently, many individuals have been inspired to pursue specific careers due to the influence of science fiction narratives. However, from the lack of evidence, it is clear that these narratives need to be more researched. It is necessary to explore further how film can influence one's career choices, specifically in space exploration. As people question the future, many look toward space. Researching the impact of science fiction on the astronomical workforce can shed light on how exposure to specific narratives can be utilized to recruit future scientists. This research explores the question: Which elements, realistic or fantastical, in science fiction contribute more significantly to inspiring individuals to pursue careers in space exploration, and what specific aspects of these narratives resonate with professionals and those hoping to pursue a career across various fields related to space?

Literature Review

In researching this topic, an extensive review of the literature on multiple topics was

needed. Those categories are film and its impact on career interest as a whole, science fiction and its impact on an interest in science, realistic narratives in science fiction, and fantastical narratives in science fiction.

Film and Career Interests

Substantial research has been done regarding film and its influence on career choice. The famous television show Grey's Anatomy, for example, is widely known to significantly impact the medical field, as it has influenced countless individuals' career choices (Zigmont & Wolfe, 2023). Research, such as Zigmont and Wolfe's 2023 study on Sources of STEM and STEM Career Messaging for Adolescent English Learners, has indicated that "participants' interest in STEM careers has been fueled by what they have viewed," with television playing a significant role in promoting this interest (Zigmont & Wolfe, 2023). Beyond the idea of film influencing career choice, researchers have aimed to study the reasonings behind this impact. From this, film and career choice research commonly explores how characters can influence career preferences. It has been concluded that television can influence one's desire to obtain a goal occupation that aligns with one's favorite characters (Morgan, 2017). This theme is also common in research on science fiction and its potential influence on career aspirations or goals. For instance, Consolmagno's 1996 research found that at the Massachusetts Institute of Technology (MIT), the number of women in the incoming freshman classes more than doubled from 1970 to 1974. This boost can be accredited to science fiction, as many of these young women mentioned *Star Trek* as a large factor in their decision to enroll. The series, which depicted female scientists working alongside male scientists, presented a potential reality when males dominated the field, inspiring young women's decisions to enter the field (Consolmagno, 1996). Similarly, Mendick and Williams's 2009 research concluded that television has a role in helping people to aspire to

non-traditional occupations (Mendick & Williams, 2009). Regarding character alignment, Mendick and Williams's study also found that young people utilize television drama to "make evaluations of other people and of their self as they relate to others." As young people want work to provide a lifestyle that suits them, these evaluations impact their choice of career (Mendick & Williams, 2009). While it is clear that characters within film may impact career choice, there is little to no research regarding other factors that may also have this effect. In addition, it is also essential to explore the ways in which a specific genre of film, such as science fiction, may impact career choices.

Science Fiction and Interest in Science

It is known that popular culture, especially science fiction, can introduce matters to the public in both an accessible and entertaining manner (Novakova, 2021). Because of this, science fiction has been utilized within the scientific community to increase interest in STEM and to present any related fields' current state and potential future (Novakova, 2021). Namely, the Museum of Science Fiction's annual Escape Velocity event combines science and science fiction to promote interest in the science, technology, engineering, arts, and mathematics (STEAM) educational areas (Viggiano et al., 2020). Previously, NASA has taken advantage of this annual event and played a significant role by hosting exhibits, sessions, and workshops (Viggiano et al., 2020), exhibiting some of the ways that the scientific community can and has utilized science fiction to promote an interest in science, and potentially career interest. These efforts are likely driven by prior research on science fiction and science, which has found science fiction to have a positive influence on popular acceptance and support of scientific endeavors, in addition to inspiring viewers to think broadly and deeply about science's social position in diverse ways (Menadue & Jacups, 2018) (Orthia, 2019). Beyond acceptance and support, research has also

concluded that science fiction, namely *Doctor Who* and *Star Trek,* has influenced people's choice of career (Orthia, 2019) (Consolmagno, 1996). According to Stanway's (2022) findings, of the 36 University of Warwick Astronomy & Astrophysics research cluster members surveyed, 80±14 percent of astronomers liked and/or felt influenced by science fiction. In addition, Stanway surveyed 239 astronomers and space scientists at the UK National Astronomy Meeting 2022. Of these 239, 69±5 percent of astronomers believed that their life or career choices had been influenced by the genre, in many cases strongly so (Stanway, 2022).

Upon reviewing the literature, it is clear that participants' career choice was affected by science fiction which can be defined as either realistic or fantastical. For the purposes of this research, "realistic" science fiction symbolizes or is something that could happen or exist in real life. On the other hand, "fantastical" science fiction is defined as being unrealistic and exhibiting something that (from our current knowledge) could not or does not exist in real life. It is important to note that fantastical and unrealistic are used interchangeably throughout this study.

Realistic Depictions in Science Fiction

In many cases, people who watch science fiction may believe the film they are watching is scientifically realistic. Menadue and Jacup's 2018 survey on science fiction readers found that 62% of the 893 respondents believed reading science fiction made them more likely to believe in 'real' science (Menadue & Jacups, 2018). Although the study participants were science fiction readers, this relationship also exists between viewers and science fiction films. For instance, Barnett and others focused their research on the science fiction film *The Core* and its impact on middle school students' understanding of earth science concepts. Results concluded that "scientifically correct explanations of *some* basic earth science" created a series of plausible ideas that made sense to students and, therefore, influenced their perception of the concepts

(Barnett et al., 2006). In this way, the realistic narratives in science fiction were influential enough to influence viewers' own beliefs.

Realistic depictions, such as those in the 2014 film *Interstellar,* have the ability to generate scientific advancements. The film, which is said to hold a "relatively high level of scientific accuracy," follows astronauts as they set out to explore a system of planets orbiting a supermassive black hole. The film prompted Jeremy D. Schnittman's real-world research on the "(un)inhabitable environment of a planet orbiting close to a giant, accreting black hole" (Schnittman, 2019). In his research, Schnittman directly names Interstellar as the main motivator for his study. Although Schnittman's research does not exhibit realistic science fiction impacting career choice, it does highlight the impact realistic science fiction can have on scientific pursuits.

As science fiction that has realistic elements has proven to influence one's understanding of science (e.g. Menadue & Jacups, 2018 and Barnett et al., 2006) as well as influence scientific endeavors, it is possible that realistic science fiction can also impact one's career choice.

Fantastical Depictions in Science Fiction

While some films may be scientifically accurate, they are still restricted by Hollywood sensitivities and limitations (Schnittman, 2019), resulting in science fiction that portrays fantastical concepts. For instance, many space science fiction films depict the gravity of other planets, such as Mars, the Moon, and *Avatar's* Pandora, the same as Earth's (Ballesteros & Luque, 2016). Despite these unrealistic portrayals, science fiction can still influence one's interest in space. Science and our knowledge of the universe are constantly adapting and changing based on new information and findings, which is one of the many appeals to potential scientists. Weiss's 2009 study on the fantastical materials and technology of the science fiction series *Star Trek* found that the series appealed to many because the technology depicted offered a

glimpse of a potential future (Weiss, 2009). In turn, this would inspire people who aimed to be part of groundbreaking scientific and technological advancements to pursue a career that would allow them to take part in these advancements. Fantastical science fiction technology such as The Cylon Centurion from Battlestar Galactica or HAL 9000 from *2001: A Space Odyssey* represent the risk that some fear of artificial intelligence as it becomes more utilized within our society (Viggiano et al., 2020). As we make greater use of technology similar to that depicted in the films, these narratives become more realistic to viewers, and those who perceive television as socially realistic are likely to incorporate television messages into their aspirations (Wright et al., 1995). Hence, fantastical technologies within sci-fi films have the potential to affect viewers and their aspirations.

Potential Drawbacks

On the other hand, fantastical elements in science fiction can also undermine the pursuit of science as a career option. When searching how science fiction television shapes fans' relationships to science, Orthia (2019) found that some viewers of *Doctor Who* found the depictions of science were too inaccurate, fantastical, or trivial to have a lasting impact on their decisions (Orthia, 2019). Just as Consolmagno (1996) determined that while the realistic images in *Star Trek* may have inspired some to pursue a career in astronomy, the unintelligible nature of the film deterred many from this inspiration. Because of this, it is clear that fantastical science fiction may be engaging and inspiring for some but have the opposite effect on others. Conversely, realistic science fiction offers accurate representations that can intrigue viewers while potentially posing the risk of being less engaging and boring.

These findings and conclusions have led the inquiry of this study, as it is unknown which of these portrayals, considering the assets and drawbacks, play a larger role in science fiction's influence on career aspiration.

GAP

As found in existing literature, both realistic and unrealistic aspects of science fiction can potentially motivate people to pursue a career in space exploration. However, prior research does not directly label such aspects as either realistic or unrealistic. While previous research provides statistical evidence supporting the hypothesis that science fiction can influence career choice, no research has been done to determine if the realisticity of science fiction plays a role in this link. From this, I decided to explore if realistic or unrealistic, if either, contributes more toward career choice. Additionally, previous studies that have researched the link between science fiction and career aspiration merely focus on any scientific careers. While this research originally intended to focus on science fiction's impact on aspirations in a career in astronomy (such as Stanway's 2022 study), an insufficient participant pool resulted in the inquiry broadening to study science fiction's relationship with career aspiration regarding all careers related to space. This led to the formulation of the research question: Which elements, realistic or fantastical, in science fiction contribute more significantly to inspiring individuals to pursue careers in space exploration, and what specific aspects of these narratives resonate with professionals and those hoping to pursue a career across various fields related to space?

Methodology

To explore this question, an online survey and interviews were utilized. Procedures for this study were cleared by an Internal Review Board and determined to be ethical and non-invasive. Participants included professionals who already have a career related to space

exploration as well as college students in classes related to space, such as astronomy and astrophysics, who wish to pursue a career related to space exploration. For this study, a career in space exploration includes any career that contributes to the development of space exploration. Because of this, participation was open to astronauts, astronomers, technicians, engineers, and countless other careers that fit into the definition.

In addition to having or hoping to have a career related to space exploration, college students and professionals assumingly hold a relatively high level of scientific knowledge. By controlling the participant group to those who are studying or have studied scientific subjects in an academic environment, it is inferred that participants can accurately distinguish realistic and unrealistic narratives and elements when speaking of science fiction. Moreover, as the purposes of this research refer to career aspiration, it is most valuable to get the opinions of those who presently have or have followed an aspiration to pursue a career related to space. For these reasons, these groups were the most suitable for this research.

Participants were gathered in various ways. For the professional category, emails were sent to companies in the field of space exploration, including aerospace and spaceflight companies, rocket labs, and more. To recruit participants studying in colleges and universities who wished to pursue a career in space exploration, participant outreach was mainly done through Instagram. Various clubs such as the SEDS (Students for the Exploration and Development of Space), rocketry teams, and space programs from colleges and universities around the country were contacted this way. In addition, professors, undergraduate, and graduate students were contacted through email, which were found on their respective school's astronomy pages. All emails and messages included a link to the online survey and a flyer containing a QR code, which led to the survey (See Appendix A). Those contacted were asked to participate in the

survey and, if possible, help spread the survey to others interested in participating.

Survey

When beginning the survey, participants were given an informed consent form. They were notified that participation is completely voluntary, no personal data would be recorded, and they may stop taking the survey at any time (See Appendix B). To proceed with the survey, all participants had to respond yes to the informed consent form. If participants responded "No," they would be prompted to submit the survey.

Participants were then asked if they had a career related to space exploration, were a college student and wished to pursue a career in the field, or were a college student but did not wish to pursue a career in space exploration. Those who did not wish to pursue a career related to space exploration were prompted to submit the survey but did not answer the remaining questions.

Participants who had given their informed consent and have or plan to have a career related to space were then asked if the science fiction that has influenced their career choice was realistic or unrealistic and the extent of this influence. Other questions were asked to determine their opinions on science fiction and its potential to impact career choice (See Appendix D for survey questions). The survey consisted of multiple-choice and scaled-response questions, with no free-response questions being asked.

Demographic information, including gender, age, and race, as stated in the U.S. census, was collected at the end of the survey. Participants were then asked if they would be willing to participate in an interview. Those who responded yes were asked to provide a regularly checked email address, while those who responded no had no personal information recorded and were prompted to submit their survey (See Appendix C for Interview Recruitment Email).

Interviews

Interviews expanded on questions asked in the survey and allowed participants to provide their opinions and thoughts on the subject. After originally planning to conduct focus groups, the methods for this research were changed to interviews after a few weeks of data collection. While focus groups were planned initially due to the benefit of a discussion between experts, the uniqueness of the research topic left lower participant levels than initially anticipated. In addition to participant numbers, asking questions in an interview as opposed to a focus group allowed for a more direct line of questioning and the interviewee's responses not being withheld or swayed by the opinions of those around them. As this research sought to determine how and why science fiction personally impacted participants, interviews ultimately allowed for personalized questions based on participants' responses. For instance, all interviews aimed to gather the same information; however, some participants were asked questions that were different from those asked in other interviews. All interviews began with the same line of questioning: What specific science fiction works or elements influenced your decision to enter this field, and in what ways was it realistic or unrealistic, depending on what they said impacted them in the survey. They were also asked why they believed it impacted them (See Appendix E for Interview Transcripts).

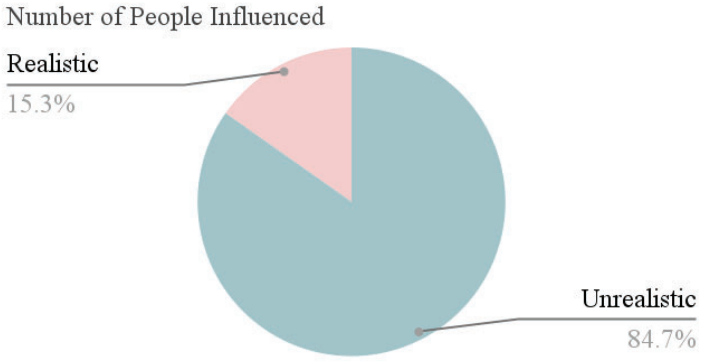
Survey Results and Analysis

In total, the survey received sixty-one responses. Two respondents described themselves as attending classes related to astronomy. Still, they did not aim to consider any related fields as a career choice and were therefore prompted to submit the survey, leaving fifty-nine viable responses. Forty participants identified themselves as male, eighteen identified themselves as female, and one participant identified themselves as non-binary.

The most notable result found from the survey is the type of science fiction that impacted

the respondents' choice of career. Fifty respondents (84.7%) defined the science fiction that impacted their career as unrealistic, with only nine respondents (15.3%) claiming that the science fiction that impacted their career choice was realistic (See Table #1 below). This finding corresponds to the first half of the research question: which elements, realistic or fantastical, in science fiction contribute more significantly to inspiring individuals to pursue careers in space exploration, and what specific aspects of these narratives resonate with professionals and those hoping to pursue a career across various fields related to space?

Table #1



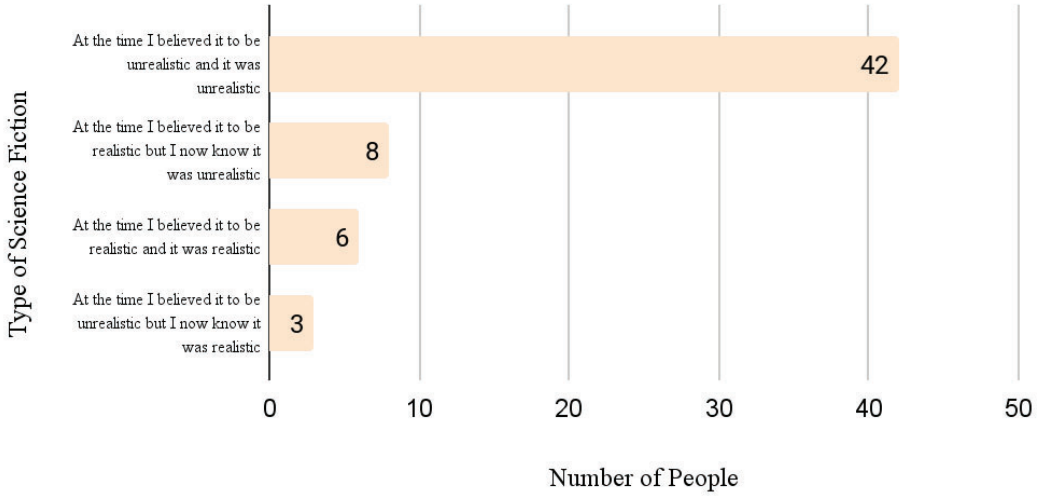
This finding implies that science fiction that is unrealistic has a significantly larger reach on individuals when considering science fiction impacting career choice.

Of the fifty that had been influenced by unrealistic science fiction, forty-two had believed it to be unrealistic when viewing. The other eight believed it to be realistic but have since realized it was unrealistic (See Table #2 below). Of the nine that were influenced by realistic science fiction, six had known it to be realistic, while three believed it to be unrealistic but have since realized it to be realistic fiction.

Research Sample C 13 of 60

Table #2

Type of Science Fiction that Influenced Respondents



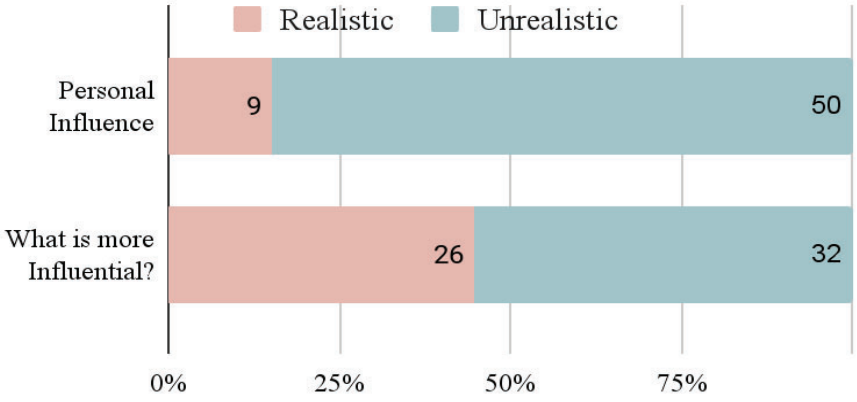
These findings were further explored in interviews, as those who believed science fiction to be realistic but have since realized it to be unrealistic were asked: If you had known it was unrealistic, do you believe this would have lessened or impacted its influence on you? However, this line of questioning yielded in no concrete findings on how these misinterpretations have impacted viewers (See Appendix E for Interview Transcripts and Respondents Answers).

Additionally, the survey obtained discrepancies among respondents' answers. As stated above, a significantly larger number of respondents (84.7%) claimed that the science fiction that impacted their career choice was unrealistic. In contrast, when asked, “When considering that both realistic and unrealistic science fiction may have an impact on career interest, which combination would you consider to be more influential?” participant responses were far more evenly distributed. While only 1 participant responded, “I do not think science fiction can influence career choice,” 32 participants chose “Mostly unrealistic (fantastical) with some realistic elements,” while the remaining 26 participants stated “Mostly realistic with some

elements of fantasy." As shown in Table #3 below, when comparing the number of individuals who were personally impacted by unrealistic science fiction and the number who believe it is more influential, some participants' belief of what is more influential does not align with what has personally impacted them.

Table #3

Personal Influence vs. Belief of what is more Influential



As this research merely aimed to discover which element has played a larger role in influencing career choice, this discrepancy, while slightly investigated in interviews, was not further investigated. Future research can further explore evidence of this disparity as well as the potential reasoning and impacts of this inconsistency.

In addition to establishing that unrealistic elements in science fiction play a larger role in career choice, this research has confirmed the significance of research regarding this topic of inquiry. Namely, the question "How much would you say science fiction has impacted your choice in career/potential career?" was asked with a 4-point Likert scale. The average score of this question was 2.83, indicating a moderate level of influence, which corresponds to the findings of previous works as discussed in the Literature Review (Appendix F). Furthermore, the question "Do you believe Science Fiction and Fantasy influence how we relate to new ideas and

concepts in the real world?" was also evaluated using a 4-point likert scale (See Appendix F). The average score of average score of 3.49 indicates that participants "Definitely" believed science fiction to be influential to one's relation to new ideas and concepts in the real world. The additional question of: When considering that science fiction influences how we relate to new ideas and concepts in the real world, do you believe that science fiction is a valuable tool in getting people interested in space as a potential career? Why or why not? being asked in interviews further signifies the significance of this research and future research on the topic, as all respondents that were asked the question strongly believed science fiction to be a positive tool in promoting career interest (Appendix E Interview Transcripts).

Interview Findings and Analysis

A total of six interviews were conducted, with three being held online through Zoom and three done through email. Although all interviews were intended to be held on Zoom, several scheduling conflicts resulted in interviews being done over email. All Zoom interviews were around 20 minutes, with pre-set questions being asked to respondents. Zoom interviews were recorded for transcription purposes. At the beginning of the interview, interviewees were read the informed consent from the survey and were notified that the meeting was recorded. All interviewees fully consented to the recoding as well as their responses being used for the purposes of this research. All six interview transcripts (Appendix E) were coded using thematic analysis to determine any recurring themes in specific narratives and depictions in science fiction that personally impacted them (See Appendix F).

Interview Thematic Analysis

The process of thematic analysis was done to explore the second half of the research question: Which elements, realistic or fantastical, in science fiction contribute more significantly

to inspiring individuals to pursue careers in space exploration, and what specific aspects of these narratives resonate with professionals and those hoping to pursue a career across various fields related to space? Five major themes were identified (See Appendix F for this process). They are as follows:

1. Wonder. Wonder corresponds to science fiction that portrays the mysteries and beauty of space exploration, mostly generating an overall interest and fascination (wonder) with science and space, which later evolved into a career interest.
2. Realistic physics, such as relativity and time dilation found in movies like Interstellar or Planet of the Apes. This theme allowed participants to help conceptualize what science is actually like, providing a more realistic view of scientific elements among fantastical films.
3. Possibilities. Possibilities was captured by the idea of finding out more about the universe and the portrayal of the possibilities that come with new information that is found.
4. Problem-solving, which was depicted by characters that apply analytical thinking and creative problem-solving skills to overcome challenges, much like what is needed in scientists studying in the field of space exploration.
5. Views of the Future. This theme, although similar, is different than possibilities. Whereas the possibilities theme corresponds to the discovery of the possibilities that come with new findings, views of the future are simply depictions of futuristic scenarios and advancements. Essentially, the portrayal of a future society.

As these five themes were found multiple times within the six interviews that were conducted, it appears that these themes are the narratives in science fiction that most strongly influence career aspiration.

In multiple interviews, a recurring topic was the concept of a work's depictions of what is real and what is not. Simply put, it is not only important what science fiction portrays, but the way that it is portrayed plays a large role as well. As stated by Interviewee #5, something fantastical should be portrayed as fantastical and it must be "obvious that those movies are not trying to misrepresent them as being realistic." This statement corresponds to something brought up by the first interviewee, as they explained that an overly fantastical film may cause someone to "overlook the real physics that are grounding it and assume that it's not based on something actually real." This can be detrimental to a film's interest in career, as previous studies have concluded that people aren't likely to be influenced by something that they can not connect to or do not think can be real. From this finding, it can be concluded that for film to have an impact on career choice, a viewer must be able to determine what is real and what is not.

Conclusion

Overall, this study suggests that unrealistic science fiction has had more of a significant impact on career choices. Aspects such as wonder, realistic physics, possibilities, problem-solving, and views of the future are most influential among those whose careers have been influenced by science fiction. These findings can be utilized within science fiction or media that capture space to promote careers related to space sciences. Unrealistic science fiction may have a greater impact on individuals, but the realisticality of science fiction may not play as significant of a role on influencing individuals than the narratives within science fiction. When considering utilizing realistic and unrealistic elements in science fiction to impact one's career aspiration, it is important that the portrayal of these elements correspond to its realisticality.

Limitations and Future Research

A potential limitation of these findings is an individual's perceptions of what is realistic and what is unrealistic. While one may perceive a scene as realistic, another may perceive the

same scene as unrealistic. Because participant's responses of what is realistic and unrealistic were left to their own interpretation, some may have claimed that the science fiction that impacted them was realistic, but it may actually be unrealistic and vice versa. However, as stated in the methods section, it can be inferred that the participant group of this study has a strong knowledge of scientific subjects. Because of this, the limitation of difference in perceptions is unlikely to have significantly impacted the findings discussed.

Although the statistics found in the survey reveal unrealistic science fiction has influenced a greater number of individuals, it can not be concretely concluded that unrealistic science fiction has a higher degree of influence on viewers, especially when considering the themes found through the interviews. The themes, such as realistic physics and problem-solving, can mostly be defined as realistic. This can likely be attributed to the fact that solely realistic or unrealistic works may not influence scientists but a mix of both. This idea was explored in interviews, with multiple participants saying that each type of science fiction influenced them in a different way. Interviewee #4 wrote that the "more fantastical, futuristic earlier sci-fi franchises influenced [their] interest and wonder in space while the more technically accurate ones helped [them] conceptualize what being a space engineer or astronaut might actually look like." Other interviewees provided similar responses, with Interviewee #3 describing that fantastical science fiction is more influential when it has some elements of realism. This unexpected finding is important when considering science fiction's impact on career choice, as respondents' reasonings for this impact should be looked into, considering they are following/ have followed this career path based on both realistic and unrealistic science fiction. In terms of this research, the limitation of population size (6 interviews) resulted in insufficient data to draw a conclusion on how realistic and unrealistic science fiction work together to affect viewers. This combination of

unrealistic and realistic science fiction and the ways in which they can simultaneously impact career choice can and should be further explored in future research. If done with a larger population sample, future research can determine what aspects are more successfully shown unrealistically, what aspects are shown more successfully realistically, and how they can be combined to influence a larger number of people.

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APPENDICES

Appendix A: Recruitment Flyer

Appendix B: Informed Consent

Informed Consent: This survey is part of a high school AP Research project. All information you provide in this survey, including demographic information, may be used in my final report. Data will not be personally identifiable. No names or emails will be included in the final report. You may stop the survey at any time for any reason, you will not face any consequences. Your data will only be included if you click the "submit" button at the end of the survey.

Appendix C: Email Template for Interview Scheduling

Hello,

I am emailing you regarding a survey you recently took concerning science fiction and its influence on career aspirations. When asked if you were open to participating in an interview you answered yes and provided me with this email. If you are still willing to be interviewed, I would like to schedule it as soon as possible.

Essentially, the interview will build upon the questions asked in my survey to answer the overarching question of whether realistic or unrealistic science fiction contributes more significantly to inspiring individuals to pursue a career in space exploration and what narratives have this effect.

The interview will be held on Zoom and take around 15 minutes of your time. Does _____ or _____ work for you? If you have another proposed date/time or no longer would like to participate in an interview, please notify me as soon as possible.

Thank you for your participation,

My name

Appendix D: Survey Questionnaire

Science Fiction and Career Aspiration

Informed Consent: This survey is part of a high school AP Research project. All information you provide in this survey, including demographic information, may be used in my final report. Data will not be personally identifiable. No names or emails will be included in the final report. You may stop the survey at any time for any reason, you will not face any consequences. Your data will only be included if you click the "submit" button at the end of the survey.

1. I have read and agree with the informed consent above
    - Yes
    - No

Career and Career Aspiration

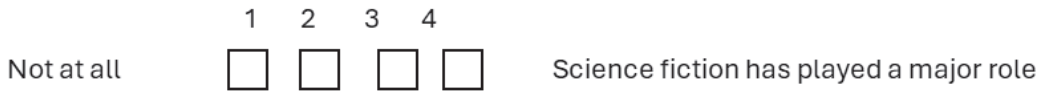
1. Which of these statements describe you?

(For the purpose of my research, having a career in astronomy means having any career related to space exploration/ aids space exploration e.g. engineers and technicians are included in this grouping)

- I already have a career related to astronomy
- I am considering following astronomy (or anything related to space) as a career choice
- I am in a class related to astronomy but am not considering any related fields for my career choice

Science Fiction Interest

1. How much would you say science fiction has impacted your choice in career/potential career?



2. If science fiction has had an impact on your career choice, would you say this science fiction was realistic or unrealistic?
    - At the time, I believed it to be realistic, but I now know it was unrealistic
    - At the time, I believed it to be realistic, and it was realistic
    - At the time, I believed it to be unrealistic, but I now know it is realistic
    - At the time, I believed it to be unrealistic and it was unrealistic

Note: For the purposes of data analysis, responses were combined to determine which type of science fiction impacted more individuals overall. (Responses of: I believed it to be realistic, and now I know it is unrealistic were added to responses of: I believed it to be unrealistic, and it was unrealistic to get an overall number of people impacted by unrealistic science fiction and vice versa for the two realistic options.)

3. Do you believe these aspects in science fiction are shown realistically or unrealistically compared to real life?

	Realistic	Unrealistic	Not shown
Technological Tools and Instruments	O	O	O
Diversity in the Field	O	O	O
Impact on Society	O	O	O
Career Progression	O	O	O
Collaboration/Interaction within the workplace	O	O	O
Discovery Process	O	O	O

4. Do you believe these aspects being realistic or unrealistic in science fiction have a greater effect in influencing career choice?

- Realistic portrayals have a greater effect.
- Unrealistic portrayals have a greater effect

5. Which statement do you believe is most accurate?

- Science fiction regarding space exploration is too fantastical to have a real impact on choice of career
- Science fiction may have an impact on career aspiration, but other factors play a bigger role
- Science fiction can largely impact one's career choice and aspiration

6. What type(s) of science fiction do you believe has had an influence on your career choice?

- Movies
- TV shows/series
- Documentaries
- Other...

7. What aspect(s) of astronomy/space sciences interest you?

- Astronomy
- Astrobiology
- Astrophysics
- Astro statistics
- Cosmology
- Data Science
- Exoplanets
- Instrumentation
- Planetary Sciences
- Space Sciences (General)
- Theoretical Astrophysics
- Technology
- Engineering
- Other...

8. How often do you find these aspects shown in science fiction film that is related to astronomy and/or space exploration?

	1	2	3	4	
Not at all	☐	☐	☐	☐	All the time

9. Do you believe these jobs should be shown more realistically in sci-fi film?

- Yes
- No
- Other..

10. When considering that both realistic and unrealistic science fiction may have an impact on career interest, which combination would you consider to be more influential?

- Mostly realistic with some elements of fantasy
- Mostly unrealistic (fantastical) with some realistic elements
- I do not think science fiction can influence career choice

11. Do you believe Science Fiction and Fantasy influence how we relate to new ideas and concepts in the real world?

	1	2	3	4	
No, they do not	☐	☐	☐	☐	Definitely

Demographics

1. I identify as
    - Female
    - Male

- Decline to state
- Other...

2. What is your age?
    - 15-30 years old
    - 31-45 years old
    - 46-60 years old
    - 60+
    - Decline to state

3. Please specify your race(s)
    - White
    - Black or African American
    - American Indian or Alaska Native
    - Asian
    - Native Hawaiian or Other Pacific Islander
    - Latino
    - Decline to state

4. Would you be willing to participate in a focus group and/or interview regarding this topic?
    - Yes
    - No

Focus Group/Interview Contact Information

1. First name

_____

2. Last Name

_____

3. Please provide a regularly checked email address.

_____

Thank you!

Thank you for taking the time to complete my survey.

Appendix E: Interview Transcripts

Note: **Bold** font corresponds to the interviewer/interview questions. Normal font corresponds to the interviewee.

Interview #1:

Okay, yeah, so that's why the consent is needed because I have to record, um, to get the transcripts later. And then I know you had to do the informed consent for the survey. It's basically the same thing. Um, it's just because it's for my, um, AP research class. So I'm going to have to submit the paper to the college board. But if I use anything that you say, it won't have your name on it. If anything, it'll be like respondent 2 or something like that. But I won't, I won't mention anything like specific about you. Okay. So, so you're fine with being recorded and stuff like that, just to make sure. Okay. So I have like, I think less than 10 questions.

So it should be pretty short. So first question, um, you said that the science fiction that impacted your career, and you said that. It had like three fourths impact, so like it did have an impact, but not like super significant impact in your career.

Yeah.

And you said it was, unrealistic science fiction.

I think more of it was.

Okay. And what, so what specific science fiction works or elements influenced your decision to enter this field?

Um, yeah, I was trying to remember these. I think I remember the Martian was a big one. I read the book, and it's very like, yeah, in the weeds. of unrealistic. It gets it.

That's one of the more realistic, like, there's fantastical things.

Yeah.

Problem solving is more like, based in physics and stuff. And so I think I think I like the whole problem-solving aspects of that, like, hooks me in, um, think about there's, um,

yeah, I think anything that had, like, relativity in it, um, I think of, I don't know if this is when I was growing up, but like, Planet of the Apes, the original one, like, The whole time dilation thing I remember. However, I learned about that, like, relatively, it was a thing that got me, like, I wanted to learn more about physics and space.

Um, this question is kind of the same, but it said, I think from your responses, you said that, like I said, the science fiction that impacted you, you said it was unrealistic, but you said at the time you believed it to be realistic, but you now know it's unrealistic.

Yeah.

Would you say that, like, if you had known that it was unrealistic when watching it, you would have been, like, less influenced?

Um, I don't think too much, because I think the things that hooked me in were probably the ones that were, were the elements that were more realistic. Yeah. Like, are the ones that actually panned out, like, some concepts that I dug into.

Yeah, like the part that Overall, it was unrealistic, but the parts that you were interested in were more realistic?

I think so, yeah.

Or the parts that would have influenced career?

I think. Yeah.

And then, so, you are saying that you believe that, like, more realistic science fiction has a greater effect on career aspiration, you think?

I think. The more realistic elements are I don't think the whole work has to be like, yeah.

So, why do you believe that the more realistic elements as opposed to unrealistic elements like have the, I guess like power to make people in like want a career in this field.

Um, I think for me, it was less like that made me want a career and more. Was things that I wanted to explore more. And then that just interest as a whole, that like developed into career maybe. Um, but the unrealistic aspects probably helped like drop me, make it like interesting the first place.

And then, sorry, I'm just looking at my questions here. So, um, I have like, I have like a list of specific, like, aspects of science fiction, like, the technology. Where is the chat? I'm going to paste them in the chat, because it's going to be, like, hard to read them all. But, there was a question on them, and I said, Do you believe they are shown realistically or unrealistically compared to real life?

And, you said that, well, like, it was a number of different answers for them. But you said that, hold on.

I can't remember what I said. I don't know if I agreed with something.

Yeah, sorry. No, um. Okay, actually, never mind. Let me just take a step back. So, um, of these, like, um, categories, like technological tools and instruments, diversity in the field. Impact on society, career progression, collaboration slash interaction within the workplace and discovery progress. Um, which of these categories, if any, do you believe had a, or have in general, a greater impact on career aspiration when shown realistically as opposed to unrealistically? So basically like in science fiction, do you believe each, like one of these or some of these should be shown more realistically than others?

Um,

Like more in the sense of like, to have a impact on career.

Yeah, I think discovery process could actually benefit from more realism because it's very like lone genius centric. And that's a big barrier for people entering scientific fields, I feel like is, that's like very ripe to cultivate imposter syndrome early on.

Yeah, I know that somebody said, like, like, I got an email from someone and they said, like, the discovery process was very, like, unrealistic because, like, the scientist in the movie has, like, a hypothesis and then the whole movie is just, it's correct and they don't really, like, show that how it's, like, takes more work than that.

So, do you think, like, maybe if that was shown a little bit more realistically, it might, like, kind of have a bigger impact?

Yeah, and like, especially if someone starts in the field and realizes it's not like that. And like, once that's why, like, once you start learning, it's not actually like this, like they might be discouraged or like not try to pursue it anymore.

And then kind of the opposite of that questions is which of these categories, if any, do you believe has a greater impact on career aspiration when shown in a fantastical way. Yeah. As opposed to realistically. So just kind of like, which one do you think should be more fantastic?

Um.

And you can say none if you don't think any of them.

I think, okay, it's not fantastical, but diversity can be more aspirational than reflecting like the current reality. Yeah, yeah. Yeah, you can prove.

Not just like fantastical, but just like not, um, like the same as it is in real life basically?

Yeah.

Yeah, like I, I think it would be better to not show the incredibly white male physics.

Yeah, when I was looking like research, it was like something about like the like woman in like a specific movie.

I **don't know if it was like Star Trek, but something had like inspired like a big surge of like woman going to MIT or something like that. So it was like, basically, you're saying like, if there was more diversity, you think. In science fiction, then, um, there would be a different, um, like, group of people that are pursuing these careers.**

Yeah, and they can help us, like, seeing that reflected. Yeah. Um, yeah, I'm a bit, I'm torn on the technology one, because I think, I think it can't be helpful to be more fantastical in, you know, At least in its way to showcase, like, real phenomenon in a more, like, if you can travel through a black hole.

That's the thing too, like, people, I always saw that, like, people can see, like, fantastical technology as, like, what could be possible in the future.

And that's kind of what makes it interesting for them. But at the same time, it could, like, pose, like, unrealistic, like, expectations in a way, like, Like this isn't it could be possible like way too far in the future that you won't be able to see it. You know?

I think something like interstellar, it's like, like, there's some fantastical things to like, get, there's like a wormhole and all the stuff to get, but then once you're like near the huge black hole, there's all these cool like real physics principles that come in and those are super exciting, but you need the fantastical technology.

Yeah, like it would just be too boring without the fantastical elements. So it's kind of like a fine line. They have to be, it kind of has to have both?

I think so, yeah.

And then, so, you, um, like, in the beginning you were kind of saying, like, it's more realistic elements that kind of, like, fascinated you. And, um, you answered that the, like, aspects of astronomy or space sciences that interest you are astronomy, astrophysics, and data science. And then I asked if you think that these, um, like aspects should be shown more realistically, but you answered no.

So I'm wondering why you responded this way? Like, I'm just wanting you to elaborate on that more if you can.

Um, yeah, I guess it does depend on the breakdown of the different aspects.

Well, I mean, I don't want to like influence any of your like, um, responses. Obviously you had like a reasoning for, for saying that.

I think I was thinking of like, I think it was probably primed by data science that I started thinking like the treachery of the job and the more like mundane things.

And I think that's like an important reality to know about, but it doesn't get people pull people into the field.

Yeah. That makes sense. But do you think like if they maybe integrated it a little bit more, but not like just like fully, you think it would be more influential, or you still think that it like shouldn't be shown that much.

No, I think you can, you can show it in an interesting way or like time lapse through it.

Like still show that it takes a long time, but just not like actually like spend that much, um, like time on it?

Yeah, I guess so.

Okay. So in a way, like just still showing it more realistically, but keeping it engaging for, for viewers. And then I think that's pretty much it, but I think I have another question, which is just. Um, it's not really specific, but like, in general, like, not regarding the things that I have brought up, like, the, the, like, categories on the side.

Do you think there are, like, there are certain aspects of science fiction that you believe are, like, more effective in sparking interest in space related careers?

Um, I mean, I think I already touched on this a little, but, like, I think there's so many cool and kind of fantastical things. About how we, like, our actual understanding of space, that you could bring those in and keep it exciting, and that it's an actual real thing that they can dig into and, like, that can spur a lot of interest, I think.

Yeah, like, just the fact that, like, kind of space in general is that we're, like, always discovering new things and, like, that's mostly what you think could be, like, most, like, shown in science fiction the most that would gain interest.

Yeah.

And then, is there anything that I haven't brought up that you think may be important or that I should address in my research?

Um, I guess, I don't have a, like, a complete thought on this, but I think the element of, like, how you convey what is realistic and what isn't.

Like, um, can you, can you explain a little bit more?

Yeah, like, how it work, cause you can have, I think Interstellar keeps coming to mind, cause it's…

Yeah, yeah, it's okay.

Um, like they have the whole, have you seen it? I don't want to

Yeah.

Yeah, like, they have the whole, like, going into the black hole and there's bookcases and stuff and it's very abstract and fantastical. Um, but then that goes hand in hand with, like, time dilation and all these, like, real physics concepts.

And so it's how, how well the work articulates what is based on something and what is Like,

Let's viewers, like, actually know what's realistic and what's not?

Yeah, which I think is hard to communicate in the work, but if, if you see the bookshelf thing, it's, And I think that it's pretty clear that that's some like abstract, but you could maybe extrapolate that and be like, Oh, well, all of this is fantastical and maybe overlook the real physics that are grounding it.

And assume that it's not based on something actually real.

So like, viewers that are watching that scene that really don't have that much knowledge about science wouldn't, um, understand the parts of it that could, that are real or like could be real, is what you're saying?

Yeah, and

I'm not sure, in that example, I think they might do a decent job of it. But just in general, like, that's just he first thing. To think about, like, Okay, I think it's like, equally important to including realistic elements that

are interesting is having it be clear that those are things that you can't actually dig into both including and the presentation and how it's shown.

Yeah, okay. Um, that's honestly all I have, but thank you so much for your time. I really appreciate it.

I, I did, um, capstone research in high school.

Oh, really?

That's what made me, like, on board.

What was, what was your project on?

Um, it was about, it was a space one, so I was already thinking about it, but it was about, uh, space junk and different ways of taking it out of orbit and cleaning up our, our orbit

So you, like, already knew what, what you were interested in?

Yeah,

Thank you so much.

Oh, when I did interviews for mine and I didn't want to talk to anyone, so I just sent them the questions. So props to you for getting on the phone.

It was like, here are the questions. If you want to chat, you can. Okay. Well, good luck with your project.

Thank you

Interview #2:

All right. Hello. Sorry about that.

That's okay. Hi. Um, obviously I want to thank you for your time. Not only for this interview, but just taking my survey. This is really helpful for me for my project. Before we get started, I have to do, um, just a consent. It's the same as the survey. As I said before, this is part of my high school AP research project. And any information you provide will not, or it could be used in my final report, but your data will not be personally identifiable. And then also this meeting is being recorded just for like transcripts later on. It's not going to really be seen by anyone. And. Yeah, so you won't be mentioned by name or anything you say won't be like too descriptive, basically. Okay. And so you're okay with being um, filmed or like recorded and everything like that? Okay. Um, I don't want to take too much of your time. I mean, it should be pretty short. I only have a couple of questions, but yeah, I think we could just get started if that's okay with you.

Sounds good.

Okay, so you said you're considering following astronomy in your career, but you're studying it right now?

Yes. Okay, so I am currently a grad student. Um, pursuing my PhD in astrophysics.

So I want to know if your perception of science fiction has changed once you began studying scientific subjects in an academic environment.

Um, I mean, yes, I would say. There's very definitely for me a line between science fiction and what is actual science and what is real, um, to the point of like, yeah, I get that science fiction isn't going to include all of the meetings and grant writing and all of that stuff that goes on in most cases, sometimes fiction does, um, try to aim more towards the realism of what academia is like. Um, and I think. That became more evident, right, as you actually are entering into academia, because when you're little, you're just like, cool, science, and you don't think about where your funding is coming from, or how long certain things would take, or what the day to day life would look like.

And do you still, um, like, enjoy watching science fiction, even though, like, It is kind of different because now you know what it's actually like.

So I think for me, for the most part, I enjoy watching science fiction. I think the ones that are most annoying for me are things like where they're just trying to use science language to sound cool, but without having any understanding of what they're saying. For example, like I still, watching Ant Man from Marvel, but Seeing them just start throwing quantum on everything is a little bit like, okay, y'all don't know what you're doing, you're just throwing it here to look cool.

And so you said that the science fiction that impacted you was unrealistic. Um, so what specific science fiction works or elements influenced your decision to enter this field? And what about it was unrealistic?

Yeah, so I think for me, a lot of what influenced it was just the, like, Wild idea of finding out more about the universe and being able to use all of that new information and do stuff with it. And I would just call that unrealistic more on like timescale type stuff of we might find out a little bit more in our lifetime. But it's so incremental and the things that come from it, it's hard to tell. And it's certainly not going to be like, you know, Every day you're working on something that's groundbreaking and life changing and all of that. Um, but I think as a kid, a lot of that science fiction just was very intriguing to read and opened up a lot of those questions and just like knowledge of how little we knew or the idea of being able to. imagine a different future.

So like what you're, if I'm getting this correctly, so like science fiction you're saying is mostly like showing like the big things of what can be possible in the future and that's what interested you even though like you know it's not going to be that big of an or not an impact just you're not going to learn that much more like as what it's shown in science yeah so it's in a way still kind of realistic but Also unrealistic at the same time.

Yeah, I think for me, those were the most impactful ones. I think obviously you can get science fiction of varying levels, um, or like varying degrees of fiction to science ratio. Um, and I think, But yeah, so I think for me, it was just that if I was going to read science fiction, I enjoy there being a fiction aspect to it. Like, I don't want to just be reading . . . Or if I'm going to read something that is mostly the actual like science or realistic

description, I would just as soon read like a biography or something that is intended to not be fiction that might be slightly fictionalized but is intended to depict real event.

So would you say that science fiction would interest you more, or how you're saying something that's not intended to be fiction?

Yeah, I think, especially as a kid, my absolute favorite genres to, like, I read a lot. My absolute favorite genres to read were, like, fantasy and science fiction much more than any, like, certainly any nonfiction and even, like, realistic fiction was.Not as much, but when I had to read, you know, um, certain either realistic fiction or biographies or something like that in school, I did tend to enjoy them, especially if it was about, I mean, okay, and those are generally going to be about people who did really cool things because that's what people like to write about. Yeah. Um, and I do think that those were important. And like had a kind of foundational of this is stuff that real people actually did, and this is real versus science fiction for me was always the story and the imagine all of the possibilities without needing to constrain yourself to reality.

And so, let me see in your survey responses you said that you believe that different aspects. Such as technological tools and instruments, diversity in the field, impact on society, career progression, collaboration within the workplace, and the discovery process being shown realistically would have a greater impact on career choice than if they were shown unrealistically.Um, can you elaborate on why you believe this? But hold on, I'll put them in the chat just because it was like really long. Yeah. Okay there. Okay, great.

Yeah, so, um, I think when it comes to like technological tools and instruments, the portrayal of those realistically, again, with the Caveat of I still think that science fiction should do the fiction aspect of it, but showing it in a little bit more realistic sense of here are things that people could actually do or that would actually work, even if we don't necessarily know how to make them work yet, if there's something that could work with our understanding of the site, like one of the things that just For me, it's always that takes it away a little bit is when there's faster than light travel because really with our understanding of physics at this point, that's not possible. Um, things going faster than the speed of light would break a lot of physics as we understand it.

So you're saying, like, maybe if that was shown, like, a little bit less, making it more realistic, it might, it would be a little bit better than, than what it is now?

Yeah, I just, I think for me, the idea of, if you're doing things that are so beyond what we, What would break all of our understanding of physics. It feels like it is pushing a little bit past the science fiction and almost more towards like science fantasy. Um, which I do think still has some bearing, but I think it's really cool to see for not predictions, but taking Okay, here are things that we understand. Let's go. You know, extrapolate from that and imagine what could be possible, but still keeping a basis in what we know.

Yeah, like this is what we have and here's what we could do with it versus like something that's really out there that just doesn't really have any like connections to real life.

Yeah, and I think for me that's why I consider those to be more impactful is just, it's easier to imagine yourself doing that or being involved in it. Um, and like, so I guess. It's something where I think it'll probably vary by person to, um, what's most impactful. But I do think that there should at least be like some of that representation is very important for understanding what it means to go into the sciences. Also, like, I guess that's just part of it of if everything is so unrealistic, you'll get a lot of people who think it's going to be cool

and start going in and then just go, well, this is not what I thought it was going to be. False expectations. Yeah, and so I think that's just something of, something to watch, like, keep from being too overly grandized.

Well, so like, let's say people do get this false expectations, and then they start, like, studying, um, like, they're hoping to pursue a career, like, this type of career, and they start studying in college, do you think that they might be, like, deterred and, like, not, like, follow through with pursuing this career, maybe?So it might be, um, more damaging to, like, career choice?

Yeah, so I think Again, it's going to depend on the person, but if you're coming in with the idea that, yeah, it's going to all be fun and there's not actually going to be work and everything is, or like, there will maybe be some work, but it will always result in these big happenings, whether or not they're like positive or negative happenings, it will result in something big. And if that's the mindset people are coming in with, I think if that's the only, like, only driving force they have to be in the sciences. It's going to be difficult for them and unless they have something else that catches their interest and makes it actually makes it worthwhile to them to keep pursuing the work, um, it is harder to say. Okay, so, or encouraging, I guess.

Okay. So like the, you were saying mostly like about technical technological tools and instruments should be like shown a little bit more realistically, but with, like, do you believe any of these categories. Could have like a greater impact on career aspiration when they're shown like in a fantastical way or like more unrealistically as opposed to realistically.

Um, so I think certain ones, to some degree, like I think that maybe taking impact on society, a little bit unrealistically just because, like, you want to, again, kind of take it unrealistically but in the realm of this could eventually be the case. Um, just to kind of give that sense of maybe you won't see this in your lifetime, but you are setting a foundation that will continue. And so kind of having stories that explore what will be happening after our contribution, I do think is worthwhile. But that's inherently going to fall into a slightly less realistic representation because we don't know. No one can see the future. Um, and the other ones I would say is just. Diversity in the field is an interesting one. Astronomy is actually one of the more diverse of the like, hard, hard sciences. It is certainly more diverse than, say, physics. Yeah. Um, but there are arguments back and forth on whether or not, like, how realistic should science fiction, or like, how realistic should stories be. In depicting what it's like. Um, I think it's worth it to have historical ones and ones that are based on actual happenings that very much depict the struggles that have been faced by my by minorities. And the varying degrees of progress that have been made and the things people are doing to try to help that. I think when it comes to stories that are not based in reality, that are intended as science fiction, make it diverse. Don't feel like it needs to be constrained by The reality, like, again, depending on the tone of the story that can fluctuate somewhat, um, but I think that having something that reflects where we want to be with diversity is going to be worthwhile and important just to have that out there and like, especially for younger kids to be seeing it. Um, I think as you get older, it's more important to kind of add in other ones that like that treat that more realistically, or at least acknowledge it a bit. Um, but in a lot of cases, I feel like that can be left more towards books that are facing reality or that are intending to confront that as a main issue aspect of what's going on. If it's not going to, like, if it's not going to be addressed in the story, I think it should just be diverse. If it's going to be addressed in the story, then it can be more realistic. Okay,

And, um, when thinking about how science fiction influences how we relate to new ideas and concepts in the real world, Do you believe that science fiction is a valuable tool in getting people interested in space as a potential career and why or why not?

I think it is a valuable tool. Um, I think part of, part of the reason for its value is its ability to reach a wide variety of people. Um, and that there are a lot of people who aren't going to be able to just sit down and read

or watch only realistic, only, only documentaries, only things that are based on science. On a historical happening. Having those is important. It's like, but that might not be enough to get someone interested or to catch someone's attention, um, in a way that science fiction can. I think it's like they appeal to different sides of people in different people. And so having both of them is really important. And I think science fiction does a good job of making some of the science seem more interesting and more. accessible than what, say, a high school physics class might do. Like, I feel like a lot of high school physics classes just are generally not great. They're either taught by someone who is not actually a physics, like, primarily physics degree or anything. Um, oftentimes it's a shared science teacher who also does chemistry or something. Um, or it's just very rushed, underfunded, like, there's a lot of reasons for classes to just not be as good. And so I think having these other things that can kind of have a rebuttal against that a bit and say, no, wait, there's actually really cool stuff going on here. And you can sit and read a story or you can sit and watch a movie where there's interesting things that are happening in addition to the science.

Is there anything that I haven't brought up like these categories or just realistic and unrealistic in general that like you believe should be looked into or is like important for my research in like regarding what might happen? Or regarding like science fiction and like career aspiration.

Yeah, I mean, I think the only thing like that would be just most interested in would be to see like I'm not sure how realistic this would be to actually do, but being that broken down by different categorization of people who got interested versus not interested through science fiction, like looking at different, yeah, different categories of people, um, gender or, uh, race or things like that. And just looking at, does it have a greater impact on any of these certain. groups, and then kind of going from there. But like, not sure how incredibly realistic that is for a high school project. Yeah, it's just an interesting point.

No, yeah, that's interesting because obviously, um, I feel like for my project, I'm not going to be able to, like, really get into that because, you know, like, most of my respondents are, like, male. So it's like, I can't really, like, create a, like, a good, like, you know, like, split, and then seeing if that impacted them or didn't, and then age too. But that is. I mean, like, obviously that's useful to me because in my project I have to, like, say how it can be, my, like, research can be, like, improved upon or, like, people can build off of it. And then, I think I just have one more question. Um, this one's kind of long. It's, although some respondents said that they believe more realistic portrayals in science fiction may have a greater effect on science fiction, when asked which combination of realistic and non realistic portrayals is more influential, they claimed that Um, mostly, mostly fantastical science fiction with some realistic elements had a greater effect. Um, what do you think could be like the cause or reasoning of this disparity and what's your opinion on it?

Okay, so just make sure that I caught all that. It's basically saying that despite originally saying that realistic portrayal. Yeah. Greater influence in reality, they find that fantastical elements had a greater influence. Um, I mean, I think one reason for it is just the fantastical is what catches people's attention in that type of story. If you are watching a movie or reading a story that is intended to be fiction. Um, oftentimes what is going to catch someone's interest, especially if they are not. Um, I think that the people who are originally interested in science or don't consider themselves a science person is going to be the larger than life and the exciting pieces, and so I think that drumming up of excitement is one of the strongest like points in favor of the fantastical elements, and that they just are able to do that. And then once you're. In the field, you look back on it, and you kind of are seeing, oh, but there are all these realistic things that helped to see yourself in it, or helped you to think of what could I do to get closer to that, or how would I do that particular thing? So I think once you're in the field, you can kind of look back and see how those realistic effects actually were integrated into the back of your mind, and were just kind of sitting there.

And do you think, like, these people, how you're saying, are already into the field? Do you think that they, just because they, like, realized that there were realistic elements that hooked, I guess, like, hooked them, um, do you think that they might believe that it should be more realistic or just, like, stay how it is?

Honestly, I think that's going to depend on how much the person has thought about it. Um, because I think people, that can be, oh, it should be more realistic so people actually know what they're getting into and you actually see the Full side of science in a realistic way, but I think there is something to be said for having the more fantastical elements mixed with realism that can draw people in that you might not otherwise reach.

Okay. Um, well that's all the questions that I have, but thank you so much for your time. I really appreciate it.

Yep. Bye.

Thank you!

See ya.

Interview #3:

Hi, yeah, can you hear me?

Yes. Awesome. How's it going?

I'm good. How are you?

Oh, not too bad. Thanks. Yeah. Sorry for being so late on the reply.

Yeah, no, it's okay. Um, well, I just want to start off by saying, uh, obviously thank you for taking the time to do this interview and doing my survey, I really appreciate it. And it just helps me in my, um, my class. And then also, um, I have to start off by just doing like a, um, uh, just like a consent thing because This meeting is being recorded and I know you had to do the informed consent on the survey. It's pretty much the same thing. Um, as you know, this is part of my high school AP research project. All of the information you provide, may be using my final report, but data will not be personal personally identifiable. No names or emails will be included in my final report. And you can obviously stop at any time.

Perfect. Sounds good. I consent fully. Yes.

All right. And this shouldn't take too long. I only have a couple of questions for you. You said you already have a career related to, like, space exploration.

Yes, technically, I am currently pursuing a bachelor's in mechanical engineering. I'm in my 2nd year and I am technically already involved with the University of Victoria rocketry team. Yep.

Okay, and you said that the science fiction that impacted your career choice was realistic. Um, what specific science fiction works or elements influenced your decision to enter this field and in what ways was it realistic or how did it impact you?

Yeah, so I think, so I think in terms of like realism, it's not so much the sense of like, they're showing you like the exact equations or like what's happening, but it's the idea that they've, they've either taken concepts to logical extremes or that something is believable, like, for instance, um, moon is a harsh, the moon is a harsh mistress by Robert A. Heinlein. It's a classic work of science fiction. Um, in that it talks about, like, a moon trying to become independent, but a part of that is it talks a lot about, like, um, the colony that's on the moon and like all the people there. And it talks about the infrastructure, um, how life would work, specifically how, like, culturally and socially life would form around, like, new technology in that environment. So specific, so, like, realistically. Um, it's the sense that it's showing ideas of what could be and you believe it. Like you can see, you very much so have a sense that like, this is possible if there's enough time put into it and could see it down the road. And like how that impacted me is seeing realistic or believable or like, Oh yeah, that seems like that could one day happen is it gives like an excitement almost. It shows like, Oh, this is what the field is now, but this is what it could be, or this is what you're helping build towards, which is quite exciting.

Okay, so it's like, basically, it's, it's what could be realistic more, more than like, um, what is actually realistic for life right now.

Yeah, like, I don't think I've ever read a, like, another aspect of, like, sci fi would be, like, Starship Troopers, by the same author, Heinlein or Isaac Asimov, even, or Dune, even, like, in Dune, they talk about the concept of stillsuits, the idea that, like, you wear this suit, and it, like, stops any water from being wasted while you're in the desert. That seems like something that if you had to, you could develop it in Starship Troopers. They talk about, um, sort of wearing like exoskeleton type armor that lets them leap around and jump a couple buildings in height. And so it's, yeah, it's not so much that they've gone ahead and done something that already exists. It's that they've created fictional pieces of technology that you or I wouldn't be surprised if we saw it in a news line one day.

Yeah, and so this next question is kind of long, but, um, in this survey, you responded that aspects such as technological tools and instruments, diversity in the field, impact on society, career progression, collaboration slash, slash interaction within the workplace, and the discovery process have a greater effect on career choice unrealistically. And can you explain why you believe this? But hold on, I'll put the things in the chat because it's really long.

Yeah, that'd be awesome if I could see that. Okay,

So those, um, different, um, like, which aspects would you say would have a greater impact if shown realistically.

Yeah, so I think with what, I mean, what, what I meant by that just 'cause the phrasing of the question is a bit like, do you mean like realistic in terms of like it already exists versus it could exist? Right? Like that's, that's where I think, like my understanding may have wavered a bit because I saw unrealistic things is technologies that I didn't believe were realistic or things that I couldn't wrap my mind around sort of.

So, so you, um, like, saw it as unrealistic would be, like, things that couldn't be realistic, even in the future, versus realistic is like, it could be realistic, but it might not be realistic right now.

Yes, exactly. I saw realistic as including even things 100 years from now, where I see existing. Like, for instance, if, like, a peasant in the Middle Ages could not comprehend the concept of this, right? A smartphone. When you, when you consider. Um, yeah, when you consider like, like just what they had at their time, the idea of like electricity is literally black magic. Right? And so what I, so what I interpreted the question as for the record is that unrealistic technologies are things that I couldn't possibly fathom being real versus realistic being anything in the future. And so with this, so basically like technological tools and instruments and all that stuff, having more impact. Um, Basically, because they're realistic is because it's sort of that cause and effect. So, like, in that, in that moon book, the moon is a harsh mistress. You see, how would a society change or wrap around technology and certain, like, innovations and stuff in the science? If it's done in a meaningful way, like Dune by Frank Herbert, it's very much a book about what can, how does people rise based on certain conditions, right? How does technology play into that? Isaac Asimov does the same with the idea of technological regression. And so, to me, and I'll try and be succinct here, to me, all of these, from technological tools to diversity and collaboration in the workplace and the discovery process, all of these have a greater impact on me as a person when it's realistic, because of the fact that that you can make a connection to it. At least for me, I had the excitement of seeing where things could lead or how what I do can impact the world and things around me.

And so this is kind of the opposite, but do you think like of any of these categories, any of them shown like in a more fantastical way, um, as opposed to like real life would have a greater impact on, on people?

So sorry, so the question is, like, if any of these individually are shown in a fantastical way, like, I couldn't perceive it to be possible, um, would those also have an impact on, like, my career choices? So, yeah, so I think, yeah, I mean, I'm trying to think. Like, obviously there's something to be said about, like, the wow factor or something. Um, yeah, but it's, like, shown in, like, If we, if we call fantasy like as well, like what we don't think would happen, like things like impact on society, so to speak, like, oh, the robots take over or something like that. Right. I don't I don't know if that would have an effect, so to speak. Yeah, I don't at least in my mind, it wouldn't have as much of an effect just because if I could, if I saw something is just like. is like not even possible in the slightest. I don't really see it affecting me. I would treat it like reading Harry Potter or reading the Lord of the Rings. Like it's awesome, but but aside from making me maybe want to be a writer or like try different sorts of genres, I don't think it would necessarily impact my career that much. No.

So just in general you feel like more fantastical or like out of the world like kind of like things wouldn't really have that much of an impact on people's career choice.

Yeah, Lord of the Rings had a lot less of an impact on my career choice than you could argue that Starship Troopers or a book about engineering would, per se.

And then, so, some respondents earlier in the survey said that the science fiction that impacted them was realistic. However, when they were asked, like, which combination of realistic, And fantastical portrayals is more influential. They claim that science fiction that is mostly fantastical with some elements or some realistic elements mixed in had a greater effect. And so considering that these respondents were personally impacted by realistic science fiction, why do you believe they would then answer that mostly fantastical is more influential in career choice?

Yeah, so I think what they're trying to get at there, um, what they've identified really is that when you take an idea, and if you give it just a dash of like, possibility or truth, or what can happen, you immediately make it more enticing in a sense. Like, it's 1 thing. If you just say like, oh, look at this, but then if you say like, oh, but why is that and you provide a half thought or like reason for it, then it then it entices it. It makes it like it adds

something else to it because it's not just some random thought that someone had. It's, oh, no, this isn't actually interesting idea. That someone had thought maybe it's, it's completely like unrealistic, fantastical, out of scope or whatever, but the inkling of realism, even to something that's like not possible, it makes it cool. Like, like Lord of the Rings, um, like what's, what's a good example here. Or Dune, for instance, the concept of like a giant, of a giant sandworm, right? The, the, the, like, it's probably not possible, the idea of having skyscraper longworms on a planet that like, has none to eat, but it's like, the, the, the added bits of it where they do say like, oh, they have this cycle, or they have this, where you can clearly tell there is some thought, it adds intrigue. Like, fantasy without anything behind it, it just like, Yeah, it's, it lacks, to me, like, it would lack that intrigue or that little bit of enticing, in a sense, yeah.

So I feel like this kind of connects to one of my other questions, which is like, you said that aspects such as like, astro statistics, um, engineering, planetary sciences, like, and more, which interested you, should be shown more realistically in science fiction, and like, so does this kind of connect to how you're saying, like, Um, showing a bit of realism into it kind of would have that effect versus like, I don't know, like, why do you believe that this should be shown more realistically?

Well, I think it's, I think what we could say by like showing more realistically is showing something behind it, like Star Wars. I love Star Wars. Huge fan of that, right? Um, in Star Wars, you could definitely classify as fantastical. There's the force. There's like, um, uh, there's like, there's like laser guns, you could say, like blasters. Um, And I think it really is a case of where, like, it's not, like, what gives something realism is when there's explanation behind it, right? Because you as the reader, as the audience, if something is explained and not just told, like, the concept of the lightsaber, right? The idea of it is that it's basically like a long sword or flamethrower that's just powered by a really powerful thing, right? And they, and they go on to explain that and stuff. And so, like, Yeah, just by the, it's by the sake of it, like, having a realistic, like, explanation, it's not that things can't be fantastical or fantasy based. It's just giving them, whatchamacallit, giving them, like, that realistic element to go off of spark's intrigue.So it's not saying that every single thing has to be like, oh, here are the nitty gritty calculations of how you, I don't know, like, like, jumped onto a moon or something like that, but it's the thing of, like, adding a little bit of explanation to something. Like, just makes it that much more enticing. And also the fact of, like, showing people what's possible, if you make it more realistic, and then increasing people's, like, interest. So, that's also a fun.

So, you think, like, if anything shown that is fantastical should at least have some root of, like, a realistic element in it?

So the stories that would interest me, yes. I think, I think it's a overgeneralization to say that it should, per se. Yeah. Um, just because, like, we shouldn't restrict literary freedom, but as to, like, what would interest me, um, then I would say, yeah, definitely, like, like, elements of realism, even if fantastical, always make it very cool.

But, like, if we're thinking about just, like, it having an influence on career choice, obviously people, like, watch, um, or, like, watch or read just for fun, too, but, like, if we're considering if we're thinking about, like, it being influential on career choice, then, like, do you still think it should have, like, a sort of realistic element to it?

Yes, I think absolutely. Yes.

Okay. And are there certain aspects? Of science fiction that you believe are more effective in sparking interest in space related careers.

Aspects of science fiction, um, spaceships. Um, no, I think really, like. Showing showing, like, an idealized future, obviously fantastical technically now, but based on realism of, like, showing, oh, what if we had spaceships? What if we can colonize other planets? What if we can travel around? Right? So, yeah, I think I think showing. Showing a more formulated, more exciting, more romantic of what could be. Definitely. Yeah.

And then, um, when considering that science fiction influences how we relate to new ideas and concepts in the real world, do you believe that science fiction is a valuable tool in getting people interested in space and as a potential career? Why or why not?

Oh, absolutely. I mean, it's half what got me interested in space. I mean, consider this, especially for like science fiction in space, um, first of all, you don't hear about it if there's not anything there. And if something is solely fantasy. Then like, how do you connect that to what our world is? Versus if you base something in realism, either fully or even partially or even inklings, um, it really does provide that, Hey, this is what this could be. You're connecting an industry, like a vague concept, like aerospace, what is aerospace engineering? No one knows when they're first told that, but then you think, Oh, there was that book I read or that show I watched for that movie where the spaceships are flying around aerospace. And you all, they designed something that maybe one day we'll be that. So yeah.

Okay. And then last question. Is there anything that I haven't brought up, such as the like categories in the chat or anything that I asked in my survey questions that you believe should be looked into or is important for my research?

None that comes to mind. The only thing would be clarification over realistic versus fantastical. Like you may have done that and I just misread it and that's totally on me, but I would say, yeah, classify whether realistic is like with things right now or than any gritty versus it can be something that doesn't exist, That thought could be understood as one day it would be.

Yeah, no, that's fair because obviously everyone defines it differently. Like not everyone's going to define it your way as like seeing what could be possible. Some would believe like realistic is like what we have right now.

Yeah. Yeah. So for your, for your own purposes, for like trying to formulate data for yourself, providing a definition always helps, but that's also out of my hands. So like, yeah, I think you've done a great job though. Awesome.

Well, that's it. Thank you so much for your time. I really appreciate it.

Yeah. Cheers, Alyssa. Hope it works out for you. Best of luck with the class.

Bye. Thank you.

Have a good one. Bye.

Interview #4:

What specific science fiction works or elements influenced your decision to enter this field? In what ways was it realistic?

I was exposed to a lot of Star Wars and Star Trek which I loved growing up. I also really enjoyed films like The Martian and Interstellar, which were definitely a little more realistic than the former. For the more fantastical works like Star Wars, Star Trek, and then Interstellar, what was realistic was the beauty of space and the problem solving and extent of technology needed to survive. Interstellar included more realistic physics but still was pretty far out there. The Martian was the most accurate in terms of Martian conditions and human life support in space, as well as its technology and timelines. I would say that the more fantastical, futuristic earlier scifi franchises influenced my interest and wonder in space while the more technically accurate ones helped me conceptualize what being a space engineer or astronaut might actually look like.

In your survey response, you said that the science fiction that had an impact on your career choice was realistic but at the time you viewed it, you believed it to be unrealistic. Can you elaborate on why this is? What about it did you believe was unrealistic, but turned out to be realistic?

Well, the fantasy/sci-fi worlds were pretty clearly unrealistic both before and after studying what I am now, but as for The Martian, I thought it was unrealistic as in it was unattainable to someone like me. But now I see that all the problem solving, knowledge, and technical skills are very possible for someone like me.

In the survey, you responded that aspects such as technological tools and instruments, diversity in the field, impact on society, career progression, collaboration/interaction within the workplace, and discovery process have a greater effect on career choice when shown realistically as opposed to unrealistically. Can you explain why you believe this? Which of these categories, if any, do you believe have a greater impact on career aspiration when shown realistically instead of unrealistically? Why? Which of these categories, if any, do you believe has a greater impact on career aspiration when shown fantastically instead of realistically? Why do you think this?

I may amend the statement I chose earlier. While the field I am in is not as diverse in reality as it is in fiction, I would highly say that representation in media is essential to career aspiration. But both I think is important: in realistic and unrealistic fiction. Unrealistic fiction makes you believe more in my opinion. It allowed to me to dream and primed me for realistic fiction which allowed me to dream about and pursue having a real career in space.

Some respondents said the sci-fi that impacted them was realistic. However, when asked which combination of realistic and fantastical portrayals are more influential, they claimed that science fiction that is mostly fantastical with some realistic elements had a greater effect. Considering that these respondents were personally impacted by realistic science fiction, why do you believe they would then answer that mostly fantastical (with realistic elements) is more influential in career choice?

In my opinion, fantastical scifi allows the viewer to let their guard down and come to the media with less preconceptions, whereas realistic media, especially if it is about a field you might be interested in exploring, can make you defensive when approaching it.

Are there certain aspects of science fiction that you believe are more effective in sparking interest in space-related careers?

I think it depends on the person, but I am a sucker for underdog stories that focus on the amazing human spirit as well as relational aspects of working together in space.

When considering that science fiction influences how we relate to new ideas and concepts in the real world, do you believe that science fiction is a valuable tool in getting people interested in space as a potential career? Why or why not?

ABSOLUTELY. It allows us to conceptualize "out of this world" ideas we might not otherwise imagine or have trouble imagining. It sparks creativity and thinking out of the box!

Interview #5:

What specific science fiction works or elements influenced your decision to enter this field? In what ways was it unrealistic? Although unrealistic, why do you believe it still had an impact on you?

My family used to have movie nights when I was growing up where we'd watch films like Star Wars and Back to the Future. In hindsight, watching movies like this helped push me into wanting to become an astronomer. While I knew that a lot of the things presented in there were science fiction, I was still entertained and enjoyed them and they made me want to work on the "science fact" side of them, such as finding new planets outside of our own Solar System.

In response to my survey, you stated that aspects such as technological tools and instruments, diversity in the field, impact on society, career progression, collaboration within the workplace, and the discovery process have a greater impact on career choice when shown unrealistically as opposed to realistically. Can you elaborate on why you believe this? Which of these categories, if any, do you believe have a greater impact on career aspiration when shown realistically instead of unrealistically? Why? Which of these categories, if any, do you believe has a greater impact on career aspiration when shown in a fantastical way as opposed to realistically? Why do you think this?

A lot of the technology shown in movies is purely for entertainment and I'm the type of person who is not bothered by this and am willing to accept it as it is. However, some tech shown in movies/TV have gone on to inspire real-world technology: for example, the Star Trek tricorder almost looks like a smart phone today. I personally think that it is ok to show some things as fantastical instead of realistic, as long as it is obvious that those themes are unrealistic.

Can you explain why you believe things such as astrobiology, astrophysics, data science, exoplanets, etc., should not be shown more realistically in sci-fi film?

I might have selected the wrong response there, but I'm ok with some of these aspects being shown as fantastical as long as it is obvious that those movies are not trying to misrepresent them as being realistic. There's a problem if a movie tries to pass off something fantastical as realistical. While I think what I do is cool, my day-to-day is mostly spent on my computer – writing code to analyze data or being in a ton of meetings. Those don't really translate well to the movie screen for entertainment purposes.

Are there certain aspects of science fiction that you believe are more effective in sparking interest in space-related careers?

Honestly, all of it. What might inspire me might not inspire others.

When thinking about how science fiction influences how we relate to new ideas and concepts in the real world, do you believe that science fiction is a valuable tool in getting people interested in space as a potential career? Why or why not?

I do! I know of tons of folks who work at NASA who also loved Star Wars and/or Star Trek while they were kids (and still do as adults) and they cite that as part of the reason why they are working for NASA today.

Interview #6:

What specific science fiction works or elements influenced your decision to enter this field? Why did it have this effect? What about it was unrealistic?

There is one movie in particular that had a huge impact on me -- Zathura: A Space Adventure (2005). It's one of my favorite movies of all time, and it's super action-packed and full of aliens. I would say the movie is very unrealistic because, although it is based on science, the story revolves around a magical board game that changes the real world at every turn (just like Jumanji if you're familiar with that movie). It didn't really have a direct impact on my decision to pursue astronomy as a career, but it certainly contributed to my love of science and fascination with space.

In your survey response, you said that the science fiction that impacted you was unrealistic. However, when you viewed it, you believed it to be realistic. What specifically did you believe was realistic and why did it affect you? If you had known that it was unrealistic, do you believe that it would have had less of an impact on you?

I think when you watch movies as a kid and then rewatch them later in life they lose some of the magic. When I was young, I thought that things like interstellar travel and hyperspeed were realistic and scientifically consistent. Now when I see science fiction films, as I am about to graduate with a degree in astronomy and physics, I can't help but think of all the things that don't make sense in science fiction films. The fiction jumps out at me far more than it used to.

In your survey responses, you answered that different aspects such as technological tools and instruments, diversity in the field, impact on society, career progression, collaboration within the workplace, and the discovery process being shown unrealistically (fantastically) would have a greater impact on career choice than if they were shown realistically. Can you elaborate on why you believe this? Which of these categories, if any, do you believe have a greater impact on career aspiration when shown realistically instead of unrealistically? Why? Which of these categories, if any, do you believe has a greater impact on career aspiration when shown in a fantastical way as opposed to realistically? Why do you think this?

I think this holds true for most fields of science, and that's because science is way more difficult to unravel than science fiction films make it seem. Inevitably, if you are certain of the career path you want to pursue at a young age, you will look at that career through rose-colored glasses. That's why I think an unrealistic portrayal of a scientific research career would impact career choice much more than a realistic one. If movies showed us the reality of what science is like, I think the movies wouldn't sell and fewer people would pursue

a scientific career. I think a realistic portrayal of the technological tools and the processes of discovery in astronomy would have a significant impact on career choice. In my experience, astronomy is just a disguised version of computer science and math. I have come to realize that astronomers don't spend their days looking through telescopes, instead, they spend their days grappling with digital software and data processing. I think that an unrealistic or fantastical portrayal of career paths in astronomy would (and currently do) have a strong impact on career choice. I believe that aspiring astronomers don't know how difficult it is to get a job in astronomy. Most people know, for example, that medical school is an incredibly long and difficult road, and not everyone makes it to residency. If aspiring astronomers knew that graduate schools in astronomy have similar and often lower acceptance rates than most medical schools, I think more people would second-guess their decision. On top of that, only a small portion of graduates with a Ph.D. in astronomy or physics can stay in the field. Funding is just not enough to keep up with the demand for astronomer positions. This is all to say that, when movies and popular culture depict the traditional career path of an astronomer, it seems much more straightforward than reality.

Can you elaborate on why you believe things such as astrophysics, cosmology, data science, etc., should be shown more realistically on sci-fi film? In what way do you believe this would impact science fiction's influence on career choice?

I think if films showed the reality of a career in astronomy, young aspiring astronomers wouldn't come into the field with a fantasy version of the field in mind. If I had known earlier just how much math and coding my daily life would be, instead of using telescopes by eye and looking at star charts, I think I would have prepared differently. If I had known then what I know now, I would have started research the moment I stepped foot in my university -- research experience and computational skills are paramount in astronomy, which is something I had to learn by trial and error, and ultimately, failure. A realistic depiction of the field in a science fiction movie might have saved me a lot of trouble down the road.

In what ways do you believe that science fiction that is more fantastical could have a greater of an influence on career choice than science fiction that is more realistic?

I'm pretty sure my other answers cover this point well. A fantastical image of career paths and the tools of discovery would have a bigger impact than a realistic depiction. I think this plays out in real time today, where many enter the field without knowing what they are getting themselves into.

Are there certain aspects of science fiction that you believe are more effective in sparking interest in space-related careers?

Definitely! Any time a physicist or astronomer discovers something in the movies, they have a breakthrough moment, write an equation on the chalkboard, and run through the halls screaming Eureka! (e.g. Interstellar) While the reality is certainly nothing like this, the portrayal of the excitement of scientific discovery is accurate. Science can be incredibly exciting, and I think science fiction movies are right in demonstrating this fact.

When considering that science fiction influences how we relate to new ideas and concepts in the real world, do you believe that science fiction is a valuable tool in getting people interested in space as a potential career? Why or why not?

Yes, but with a strong caveat. I think science fiction is a very powerful tool to gauge interest in a scientific field. It should not, however, be used as a guide for a career in science. When trying to choose a career path, I suggest young aspiring scientists reach out to the nearest university with a department in their field of interest

and ask to speak with a professional. Repeat this process many times until you have spoken with several scientists from a wide range of disciplines within your chosen field. I would much rather young scientists hear about the realities of a scientific career early on than face a field that differed from their expectations.

Is there anything that I haven't brought up (such as the categories above or anything asked in my questions) that you believe should be looked into/ important for my research?

Most of my responses above have been somewhat of a downer. That's because science is really hard, and I think science fiction played a role in giving me a false impression of the path to a scientific career. Nonetheless, if you are ready to face the challenge of a scientific career, the rewards are immensely gratifying and incredibly exciting. The thrill of making a breakthrough in your research is truly a magnificent experience!

Appendix F: Scaled-Response Data from Survey

How much would you say science fiction has impacted your choice in career/potential career?

	Response	Corresponding Score for Response	Number of Responses
Not at all	1	1-1.74	6
	2	1.75-2.49	16
	3	2.5-3.24	19
Science Fiction has played a major role	4	3.25-4	18
			Average: 2.83

Do you believe Science Fiction and Fantasy influences how we relate to new ideas and concepts in the real world?

	Response	Corresponding Score	Number of Responses
No, they do not	1	1-1.74	0
	2	1.75-2.49	7
	3	2.5-3.24	16
Definitely	4	3.25-4	36
			Average: 3.49

Appendix G: Interview Coding - Why Science Fiction Impacted Career Choice

Interview #	Text	Pass #1	Pass #2	Theme(s)
1	Problem solving is more like, based in physics and stuff. And so I think I think I like the whole problem solving aspects of that, like, hooks me in, um, think about there's, um, yeah, I think anything that had, like, relativity in it, um, I think of, I don't know if this is when I was growing up, but like, Planet of the Apes, the original one, like, The whole time dilation thing I remember. However, I learned about that, like, relatively, it was a thing that got me, like, I wanted to learn more about physics and space.	problem solving based in physics	Problem solving	Problem-solving
		relativity	Relativity	
		Planet of the Apes- time dilation	Time dilation	Physics
2	I think for me, a lot of what influenced it was just the, like, Wild idea of finding out more about the universe and being able to use all of that new information and do stuff with it. And I would just call that unrealistic more on like timescale type stuff of we might find out a little bit more in our lifetime. But it's so incremental and the things that come from it, it's hard to tell. And it's certainly not going to be like, you know, Every day you're working on something that's groundbreaking and life changing and all of that. Um, but I think as a kid, a lot of that science fiction just was very intriguing to read and opened up a lot of those questions and just like knowledge of how little we knew or the idea of being able to. imagine a different future.	finding out more about the universe and using that new information to do stuff with it	finding out more about the universe	Views of the Future
		Unrealistic, timescale	Imagining the future	
		Questions about the knowledge we have		Possibilities
		Imagining a different future	the little knowledge we currently have	

3	"Yeah, so I think, so I think in terms of like realism, it's not so much the sense of like, they're showing you like the exact equations or like what's happening, but it's the idea that they've, they've either taken concepts to logical extremes or that something is believable, like, for instance, um, moon is a harsh, the moon is a harsh mistress by Robert A. Heinlein. It's a classic work of science fiction. Um, in that it talks about, like, a moon trying to become independent, but a part of that is it talks a lot about, like, um, the colony that's on the moon and like all the people there. And it talks about the infrastructure, um, how life would work, specifically how, like, culturally and socially life would form around, like, new technology in that environment. So specific, so, like, realistically. Um, it's the sense that it's showing ideas of what could be and you believe it. Like you can see, you very much so have a sense that like, this is possible if there's enough time put into it and could see it down the road. And like how that impacted me is seeing realistic or believable or like, Oh yeah, that seems like that could one day happen is it gives like an excitement almost. It shows like, Oh, this is what the field is now, but this is what it could be, or this is what you're helping build towards, which is quite exciting.	take concepts to logical extremes or something that is believable	showing ideas of what could be and it being believable	Possibilities
		The Moon is a Harsh Mistress, Robert A. Heinlein	showing what could happen one day	
		infrastructure and how life would work on the moon		Views of the Future
		excitement of what could happen one day	how technology and life would work in that environment	
		showing what the field is now and what it could one day be		
4	I was exposed to a lot of Star Wars and Star Trek which I loved growing up. I also really enjoyed films like The Martian and Interstellar, which were definitely a little more realistic than the former. For the more fantastical works like Star Wars, Star Trek, and then Interstellar, what was realistic was the beauty of space and the problem solving and extent of technology needed to survive. Interstellar included more realistic physics but still was pretty far out there. The Martian was the most accurate in terms of Martian conditions and human life support in space, as well as its technology and timelines. I would say that the more fantastical, futuristic earlier scifi franchises	Star Wars, Star Trek	Beauty of Space	Wonder

	influenced my interest and wonder in space while the more technically accurate ones helped me conceptualize what being a space engineer or astronaut might actually look like.			
			Realistic Physics	
		The Martian, Interstellar (more realistic), beauty of space, problem solving and extent of technology needed to survive		
				Physics
			Martian conditions	

		The Martian-Martian conditions and human life support in space, technology and timelines	human life support in space	Problem-Solving

			timelines	
		fantastical and futuristic: interest and wonder in space		
			Problem-solving	
				Possibilities

		technically accurate- conceptualize what being a space engineer or astronaut might actually look like		
			extent of technology needed to survive	

5	"My family used to have movie nights when I was growing up where we'd watch films like Star Wars and Back to the Future. In hindsight, watching movies like this helped push me into wanting to become an astronomer. While I knew that a lot of the things presented in there were science fiction, I was still entertained and enjoyed them and they made me want to work on the "science fact" side of them, such as finding new planets outside of our own Solar System."	Star Wars, Back to the Future	Entertainment	Wonder
		entertianed, made them want to work on the "science fact" side	Unrealistic	
6	"There is one movie in particular that had a huge impact on me -- Zathura: A Space Adventure (2005). It's one of my favorite movies of all time, and it's super action-packed and full of aliens. I would say the movie is very unrealistic because, although it is based on science, the story revolves around a magical board game that changes the real world at every turn (just like Jumanji if you're familiar with that movie). It didn't really have a direct impact on my decision to pursue astronomy as a career, but it certainly contributed to my love of science and fascination with space.	Zathura: A Space Adventure - action-packed, full of aliens	Unrealistic	Wonder
		contributed to love of science and fascination with space	Action-packed	
		unrealsitic: based on science but the story is fantastical (magic)	Fascination	
			Fantastical Building Interest	

Academic Paper

Note: Student samples are quoted verbatim and may contain spelling and grammatical errors.

Sample: C
Score: 4

This paper earned a score of 4. There is a topic of inquiry with clear parameters throughout the paper and is well-aligned. The research question is found on p. 2, "Which elements, realistic or fantastical, in science fiction contribute more significantly to inspiring individuals to pursue careers in space exploration, and what specific aspects of these narratives resonate with professionals and those hoping to pursue a career across various fields related to space?" On pp. 2–8 the paper presents a rich discussion of scholarly literature and addresses a gap in the literature that led to the research question, restated on p. 8.

The method is detailed and replicable on pp. 8–11, supported by Appendix D (pp. 26–32). Ethical consideration is presented on p. 9, "When beginning the survey, participants were given an informed consent form …" and again on p. 15 for the interview. The number of survey participants and interview participants are provided on pp. 11 and 15. A logical defense for surveying college students can be found on p. 9, "By controlling the participant group …" A logical defense for the interview can be found on p. 11, "In addition to participant numbers, asking questions..."

The language of the paper is hyperbolic and not hypercritical. An example of hyperbolic language can be found on p. 19: "If done with a larger population sample, future research can determine what aspects are more successfully shown unrealistically, what aspects are shown more successfully realistically, and how they can be combined to influence a larger number of people."

The conclusion, while underdeveloped, is presented on pp. 16–17, "Overall, this study suggests that unrealistic science fiction …" The interview transcripts in the appendix support the themes discussed on p. 16, and therefore the new understanding is a well-supported and articulate rather than ineffectual or rich analysis.

This paper did not earn a score of 3 because the paper defends the replicable method on p. 11, "… asking questions in an interview as opposed to a focus group allowed for a more direct line of questioning and the interviewee's responses not being withheld or swayed by the opinions of those around them." The paper provides additional support to its primary evidence by a second round of information due to a mixed method approach.

The paper did not earn a score of 5 for a few reasons. The paper presents limitations only to the method, not the conclusion, and it did not provide implications to the scholarly field nor practitioners. An example of limitations of the method can be found on p. 18, "… the limitation of population size (6 interviews) resulted in insufficient data to draw a conclusion on how realistic and unrealistic science fiction work together to affect viewers." Results are oversimplified and do not consider other variables in having a career in science. Additionally, the language of the paper is competent and does not possess enhanced communication, which is the hallmark of a 5 paper. Word choice such as "realisticity" (p. 8) and formulaically presenting figures followed by explanations rather than weaving in a discussion is competent but not enhanced communication (pp. 12–15).

This paper is a well-supported, articulate argument conveying a new understanding.

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