

Original Work Proposal & Results & Completion Summary

Introduction and Statement of Purpose

For most of history, we have believed that time is independent and absolute, that it ticks the same for everyone everywhere. But what if I told you this is not true? In the early 1900s, Albert Einstein, a young mid-20s patent clerk, sought to do just this and published one of the most groundbreaking theories of his generation: the theory of relativity, consisting of special relativity, and the later published general relativity. This revolutionized the concept of space and time and brought about a series of scientific breakthroughs. But even this theory didn't answer everything, especially regarding the nature of time.

In my original work, my goal is to inform and explore the theory of relativity and its impact on our understanding of time. According to Proceedings of the National Academy of Sciences (PNAS), in approximately 60% of the most recent interactions, scientists indicated that their talks focused on “research” rather than on general expertise¹. This leads to an increased gap between scientific/academic knowledge and everyday knowledge, leading to the need for something to bridge the gap. We need to bridge the gap because, as academic and professional publisher Sciendo stated, effectual and open-access dissemination of research can build support for science². This support could be monetary support in the form of grants, which will be invaluable as scientific experiments and studies can be quite costly. The support could also be in the form of more well-educated individuals contributing to the research being conducted. As Shannon Greco, a science education program leader at Princeton's Plasma Physics Laboratory, said, “For people to be interested in STEM, you need to reach out to them”³. For people to be interested, you need to show them why these studies are intriguing and important, which can be done by educating them. The more support the science and research industry receives, the more

the chances for groundbreaking discoveries increase, ultimately benefiting society. So, for my original work, I decided to create a short documentary film. It will be specifically designed for the general public who wants to learn more about the world and the laws that govern it but have minimal STEM knowledge. I hope to educate the public through this documentary so that more people learn about science and become interested in it, ultimately leading to a more well-funded, well-equipped, and well-employed science research industry.

Review of Research

The background knowledge that I have acquired through doing extensive research and annotated bibliography assessments has allowed me to grasp the basic outline of the theory of relativity and what it says. However, to understand more, I will need to research more into the math behind special relativity and general relativity, which undoubtedly will be hard due to the knowledge barrier. To tackle this, I will need the help of a mentor who has a grasp of complex physics and mathematics. However, the most crucial part of my research will be understanding the theory's implication on time. This sounds easier than it is. From my interviews and what I have read, Einstein basically said space and time are the same. But if we can move in space, why can't we move in time? Why is the arrow of time only forward? From the research I have done so far, this has something to do with the 2nd law of thermodynamics. In fact, I am reading *The Order of Time* by Carlo Rovelli, recommended to me during one of my professional interviews, which delves exactly into this and how it might affect our perception of time.

Methodology

- **Participants**
 - High Schoolers
 - Middle Schoolers
 - College Students

- Adults

- **Materials**

To conduct my survey, I will need Google Forms and use Google Sheets to track my data. I will also need a camera (my phone), video/ audio recording software, and non-copyright videos to gather footage. I will also need editing software, predominantly Adobe Premier Pro and Adobe After Effects. Alongside this, I will need an external hard disk to store my footage and project files. I will also need Google Docs extensively to organize my research and create a script. Moreover, I will use MackinVia and Google Scholar to find reliable articles and sources. I will also use the physical or online PDF copies of relevant books that I come across or that professionals mention during one of my interviews. Lastly, Google Search Engine, YouTube videos, and Khan Academy will provide me with a lot of prerequisite knowledge that I will need to know when researching.

- **Description of Process and Procedures:**

While I have shown that there is a need for a platform that efficiently communicates science to the larger public, my first goal is to understand who to target the most and who needs this information the most. To do this, I will need to conduct a survey. My population will be college students, adults, high schoolers, and middle schoolers. I will ensure that my questions are unbiased and will ask a professional to proofread my questions. Depending on the results, I will alter my documentary and tailor it to the group that demonstrates the most interest and need.

After conducting the survey, I will need to compile my research in a systematic manner to create a script. Once the script and the basic outline of the documentary are finished, I will need to gather footage. To gather footage for the documentary, I have two options: recording my own footage or using preexisting copyright-free footage. The footage I will record will mostly be the interviews that I conduct specifically for the documentary. To record this interview, I will need a

camera for in-person interviews, which will be my phone, or screen recording tools to capture online Zoom interview footage. Moreover, I will use copyright-free footage to provide the viewers with visuals during the documentary. Once the footage is gathered, then I will need to record the voiceovers. After that, I need to edit and ensure that the documentary is interesting.

The documentary will be divided into three parts: the past, present, and future. The past deals with the understanding of time before the discovery of the theory of relativity. Here, I will discuss Aristotle, who first asked the question of what time is, and Newton's idea of time, which is absolute time. The present will deal with the time period from the discovery of relativity up to the present day. Here, I will explain what is the theory of relativity and how it has revolutionized the scientific community, specifically our current understanding of space and time. The future will deal with the limitations of the theory. It will showcase the questions that arise from theory and have yet to be answered. Here, I will delve into what the scientific community is working on, like the theory of everything and emergent spacetime.

Utilization of Higher-Level Thinking Skills

The original work I am attempting to create will surely not be an effortless process, as many higher-level thinking skills will be involved to finish a complex original work. Firstly, synthesis skills will be used often. I will have to use my background knowledge and new knowledge across various fields of digital media, education, mathematics, and physics and combine them to create an easy-to-digest, interesting, and comprehensive documentary for the public. I will also need to evaluate all the current theories, experiments, and interpretations about what time is, especially for the "future" part of the documentary. I will have to select which one is most logical and aligns the most with the theory of relativity and other established physics and mathematic laws. I will also need to analyze, organize, and break down these complex ideas with real-life examples and simple anecdotes so that it is easier for the public to understand.

Conclusions

Overall, my original work will be an interesting and informative documentary detailing information about the theory of relativity and time. My original work will allow me to step into a researcher's shoes and understand the fabric of the universe and the forward arrow of time. Jim Kakalios, a physics professor at the University of Minnesota, said that "a large part of the population is interested in science questions but insecure about their ability to understand the material"³. I hope that my original work can mitigate this insecurity, allow the public to understand complex physics topics/research, and fuel their interest in science. While there are some documentaries explaining the theory of relativity, most of them are old and do not focus specifically on time. I hope to fill this gap and am excited to embark on this original work process. I am confident that the experiences and knowledge I gain throughout the journey will be priceless and indispensable for my future in the field of astrophysics and my educational journey in college.

Results

In the survey I conducted, 61% of the participants were familiar with the term Spacetime, but 78% didn't know what it actually meant. Moreover, 83% of the participants demonstrated an interest in learning about the topic, and 76% were even willing to watch a documentary on it. This again backs up my claim that the majority of the public is interested in the scientific phenomena of the universe but still doesn't know much about it. Science communication can help with this, and my documentary specifically targets this interested audience with minimal prior knowledge of physics.

Application

As mentioned before, this documentary is aimed at the larger public interested in scientific phenomena, especially the Spacetime fabric of the universe. My documentary educates the public

about complex scientific phenomena using layman's terms and visuals. This will not only create a more scientifically aware society but also help academic research through monetary support or by inspiring more individuals to contribute to the scientific realm. So far, the process of making this documentary, from talking to professionals to reading books and articles, has helped me understand the theory of relativity and time. This research means a lot to me because I have questioned the passage of time ever since I was young. While we still do not fully understand it, I now have a grasp on the historical development of our understanding of time and our current research on it. This will be invaluable to me as an aspiring astrophysicist because to begin asking questions regarding the beginning of the universe or black holes, we must first understand the Universe's very fabric of Spacetime.

Citations

- (1) Gap between Science and Media Revisited: Scientists AS PUBLIC ... - PNAS,

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- (2) "Why Excellent Communication Skills Are Vital to a Successful Science Career." *Why*

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- (3) "The APS Forum on Outreach and Engaging the Public." American Physical Society,

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