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5/2/2022

Visualizing the Incomprehensible: The Multiverse

In 2019 the blockbuster movie *Avengers: Endgame* directed by Joe and Anthony Russo, came out to theaters, the culmination of over ten years of movies that told the stories of superheroes fighting villains to everything in between. In this movie, the heroes have to time travel at one point to alternate points of their lives. They do this by using the hero's, namely Ant-Man's "quantum technology". They use particle technology that rearranges their atoms so they become microscopic and can travel backwards in time through the fictional quantum dimension which is a place that transcends space and time. They are then able to travel to past points of their life. Although the science used in this scene is entirely fictional, it is slightly based on real science. Quantum physics and particle science is a real field of study in science that has to do with atoms and particles being broken down and rearranged, and with matter all together. Matter for those who don't know is defined as anything around us that has volume. In real science the rearranging of matter and using it to possibly discover alternate realities has been explored and researched. Why does this have anything to do with the entirely fictional science used in *Avengers: Endgame*?

The comparison of quantum physics in the movie and quantum physics in real life is due to the fact that since the 21st century, real life science has influenced the science used in many science fiction titles, especially ones about the Multiverse. This can be further explained by author Gary Wolfe in "Surfing the Multiverse" that, "Among 'hard science-fiction' writers,

quantum theory has become enormously influential. It provides something of a rationale for novels and stories that seek to question the fundamental nature of reality” (25). Besides Marvel's history with the multiverse though, the topic has a much more scientific history. The multiverse theory as defined by many scientists and writers including but not limited to Donovan Alexander is also known as the Many-worlds theory. This is the idea that outside of our universe there are other (potentially infinite) universes that are either similar or completely different from our own. There are many variants of the theory and different intricacies about it, but simply put the theory is as stated. The theory of the multiverse can be originally traced back to when Edwin Powell Hubble realized that there were trillions (possibly more) galaxies out there than just our own as discussed by Donovan Alexander (Alexander). Our understanding as humans that our universe was much more than we could fathom really starts to raise the questions of how big it is. Where does it end? What is on the other side? Time-travel, parallel universes, alternate selves, all relate back to the theory of a multiverse. As discussed by Heinrich Päs in the article, “Physics Beyond the Multiverse: Naturalness and the Quest for a Fundamental Theory” he mentions that, “whenever we encounter information, this information seems to depend on how we interpret or view a materialistic object” (1055) meaning that to believe something it must be seen or proven instead of being theoretical and thus it's hard for scientists to fathom something that isn't materialistic like the multiverse. Donovan Alexander expands on this point as he makes a statement that the universe is defined as “...everything we can touch, feel, sense, measure or detect. It includes living things, planets, stars, galaxies, dust clouds, light, and even time” (2) which indicates that once again for scientists to define something in science as real it needs to be something that can be essentially measured or traced back to in some capacity. However, with little to no evidence of how big the universe is or what is outside the universe, the only real

connections to confirming this theory are what is shown in science fiction and the theories that can be made from it. Exploring the potential multiverse has grown with the advancements of technology through the 21st century. With not much evidence to go off on about this theory, fictional stories that portray the multiverse can potentially give insight on the theory as they adapt real-science technology to their stories. In this paper I argue that science fiction's depiction of the multiverse converges with the scientific understanding of the multiverse and that the combination of the two (fiction and scientific) helps to predict and understand the visualization of the vastly unknown multiverse.

The Scientific Take

It is interesting to acknowledge the views of real scientists and theorists alike. In “Multiverse Cosmological Models” by P. C. W. Davies argues that development in recent technology (particle physics and quantum physics) has led for the multiverse theory to be much more a possibility than ever. Davies discusses that “particle physics, quantum mechanics and cosmology models lead naturally to the postulate of an ensemble of universes, or multiverses” (741). Cosmological models are in essence a mathematical description of the universe that tries to explain the reasoning of the universe's current aspect and evolution during its time. Davies explains how futuristic technology can potentially lead us to discover the multiverse or whatever is beyond or past our universe. This type of technology is also often mocked in science fiction to explain how things like the multiverse exist. An example of this can be seen in *Avengers: Endgame*, as the technology used to travel through the multiverse is by physically shrinking and being able to travel through the fictional quantum realm with “Pym Particles”. Pym Particles are

a fictional technology made by Dr. Hank Pym in the Marvel movies that allow the user to physically shrink or grow with the push of the button. These types of technology are hypothetical just like the multiverse as there can be infinite amounts of universes or there can be just one, it's all a mystery and theory until proven otherwise. It all goes back to the theory and what scientists have theorized based on the science they have and partially based on just speculation or "fan fiction". Such science being used has shown a huge step in the multiverse theory and is something that 20 years ago was not really thought about too much. Davies adds that "Nevertheless, the multiverse idea has probably earned a permanent place in physical science, and as new physical theories are considered in the future, it is likely that their consequences for biophilicity and multiple cosmic regions will be eagerly assessed" (740). As science and time goes on technology is going to get more advanced and so is our understanding as humans of the universe and beyond. To Davies point, if the multiverse turns out to be real it can create a power struggle or even present things that have never been seen before.

Author Dan Koboldt presents just a glimpse of what can be discovered in his article "Multiverses in Science Fiction" when he states, "...the consequences of multiverse theory actually go much further. If every possible outcome spawns a new universe, then there are infinite universes. There are universes where you pick a different college or a different career and are happy or unhappy with that choice. There are universes where you were never born. There are universes where humans never evolved at all on planet Earth" (1). The endless ideas have made the multiverse a science fiction writer's gold, but at the same time has helped scientists envision the potential multiverse. It's hard to imagine what more can be discovered but as technology increases it is inevitable that scientists will discover more.

The Foreshadowing of Science Fiction

Science fiction is a genre that explores the fantasizes of science to please the ever growing market of fans while also having a impact on the real world, as in Vivian Sobchack's "Limits of the Genre: Definition and Themes" she explains that science fiction "emphasizes actual, extrapolative, or speculative science and the empirical method, interacting in a social context with the lesser emphasized, but still present, transcendentalism of magic and religion, in an attempt to reconcile man with the unknown" (63). Sobchack here defines how science fiction explores the unknown and reconciles it in a way to help define and explain it and add a sense of reality to it. Additionally, science fiction shows this sense of reality by having been known to predict/foreshadow future technology. Roberto Pauras and Onoriu Colacels article "Reading Reality Through Science Fiction" presents the evidence of how science fiction foreshadows real life. Paura and Colacel express that, "Science fiction is far from dead: actually, it has assumed such a pervasive role in the popular imagination as to become indistinguishable from reality itself" (7). Paura and Colacel explain here how science fiction is not a dead genre. It is very lively and something that is consumed by society at a very high rate. Many of the highest grossing movies in today's society are science fiction. The genre itself has such a wide variety of content as well. In many factors and sub topics (mostly technology though) science fiction that is portrayed in movies, shows or books have often become real in the future. There are many examples such as computers, smart phones/tablets, spaceships, robots, etc. More specifically the movie *Space Odyssey* that came out in 2001 depicted smart tablets (essentially iPads/Kindles) which weren't invented until 2008 and later. It makes one think if this can be the same for something so wide and unknown as the multiverse. Regardless though, there are prime examples

and a notion as described by Paura and Colacel that can be used as an analogy to what is to possibly come for the multiverse one day. Even if it's a variation that's different from how authors have described it, our society evolves in the way that they imagine these topics.

In World War II, science fiction authors were recruited by the military to use their ideas to help contribute to confidential military projects. Paura and Colacel reveal that “At the time, Isaac Asimov, Robert Heinlein and L. Sprague de Camp were hired by the US Navy to work on a secret military project” (9). Now in real life and in the military for real countries, science fiction authors are being recruited to give expertise on fictional technology and or weapons that can be made to give the militaries an edge in war. The fact that the defense of a nation is connected to science fiction and imagination as a whole is something that is unusual to regular military procedure, but it is telling of the time and how much of an influence science fiction really has on the world. There is also more support towards the multiverse theory, because if militaries are listening to science fiction for answers, then what other answers can science fiction give regarding the universe. The example of Isaac Asimov, Robbery Heinlein and L. Sprague de Camp are also supportive to the overall argument of science fiction coming to life as the three writers contributed to classified projects during the war using their knowledge and imagination to help however they could. Although their projects were never shown to the public it's interesting to think how the three science fiction writers helped out during the war. This is also shown through a foreshadowing theoretical framework lens as science fiction work can be looked at as a clear indication of the future in many aspects.

Paura and Colacel lastly elaborate on this notion by concluding that, “There is really no getting around the cliché that science fiction is the literature that best captures the spirit of the time. Specifically, of this out-of-joint time where past, present and future coexist in reading

reality with the help of science fiction” (8). Science fiction has correctly foreshadowed the future while also presenting other fictional realities that may or may not come to fruition one day. The way humans predict the future by either following trends of the past or the present and connecting it by imagining what might happen in the future is all centered around science fiction. And thus the authors make it clear that science fiction encompasses the past, present and future all together in one reality. Predicting the future goes back to all the factors of looking for clues in the past and present while examining trends and imagining the possibilities. From how history has trended so far the most outlandish things thought in science fiction have come true. It really makes one wonder what can possibly happen or come in the near or distant future. Especially with things that are very unknown like the multiverse.

Fine-Tuning, Naturalness, and Avengers: Endgame: The Other Side

On the other hand some scientists have challenged the theory even with the current technology present by looking at the multiverse theory through a certain lens. As described by Hendrick Pas, in the science field this lens is known as Naturalness and Fine Tuning. These two terms are practically the same as author John MacArthur describes the terms in his article “Comprehending Creation” as “...the view that every law and every force operation in the universe is natural rather than moral, spiritual, or supernatural ” (80). In simpler terms this means that the universe and its nature have a purpose that is not unknown. So instead of defining things that are unknown we should acknowledge them as unknown before any conclusions are made. In “Physics Beyond the Multiverse: Naturalness and the Quest for a Fundamental Theory” by Hendrick Pas, there is a small section in the article where he cites from scientist Erwin

Schrödinger. Here Schrödinger mentions that scientists who are on this side often ask “What is the characteristic feature of life? When is a piece of matter said to be alive? When it goes on ‘doing something’, moving, exchanging material with its environment, and so forth, and that for a much longer period than we would expect an inanimate piece of matter to ‘keep going’ under similar circumstances.” (1060). Schrödinger’s definition of life is through the flow and function of it rather than the more scientific definition of atoms and material/matter; which is exactly the naturalness and fine-tuning method of thinking. Although an interesting take on the theory, at the end of the day it doesn’t progress the theory in ways of discovering it. However, neither side has any idea of how to discover it, as Davies even states that “The multiverse theory forces us to confront head-on the contentious issue of what is meant by physical reality...” (742), meaning that similarly to Schrödingers stance there is no real way of defining unknown factors. The multiverse is so complex, and so unfathomable that just merely thinking about it forces people to think about what they even are. This is why science fiction is so important as it helps to visualize the unfathomable. Being able to see Ant-Man and the Avengers travel through the multiverse for example, puts a picture to what we can’t understand. Even if *Avengers: Endgame's* perception of the multiverse is totally false, science fiction as a whole creates an image for society and scientists.

However, when it comes to science fiction another issue arises. Science fiction may have a history of foreshadowing the future or even providing help for scientists to innovate the future, but there are many conflicting science fiction stories which makes it difficult to determine which one can be real. An example of this can be found in *Avengers: Endgame* again. In a scene in the second half of the movie, the heroes discuss the rules of time travel. One of the characters, the hero “War-Machine” questions why the heroes can’t just hypothetically go back in time and kill

the baby version of the main villain of the movie. The scene is shown as satire but it leads to a discussion where the character “Professor Hulk” discusses that time travel doesn’t work that way, where going back in time does not affect the future but instead creates a branch timeline with an alternate universe. War-Machine and some of the other heroes including Ant-Man, and Hawkeye then question this verdict by listing a handful of movies where the time travel rules are as War-Machine originally thought, which include Star Trek, Terminator, TimeCop, Time After Time, Hot Tub Time Machine, etc. The reason that this scene is important is because it brings up a genuine question: if science fiction can potentially foreshadow the future or inspire scientists in their work, which source do you follow if they contradict each other? Author Charles Seife of the article “Physics Enters the Twilight Zone: Parallel Universes Have Launched a Thousand Bad Science-Fiction Plots. Now Mainstream Physicists and Cosmologists Are Arguing That They Are Both Useful and, in an Infinite Cosmos, Inevitable” answers this question as with the theory still being so hypothetical and incomprehensible, he states that, “Many Worlds is a self-consistent way to describe our nature, but it is still "unsatisfying," says Wineland. None of the interpretations of quantum mechanics has the ring of truth, but experimentalists can avert our eyes to the [interpretation] problem..." (464). In this case, Seife quotes author David Wineland who articulates that the Many Worlds (Multiverse) theory is a scientific theory that helps to describe the universe but still lacks enough evidence that it isn’t certain enough to take seriously. Wineland goes a step further to say that even in quantum mechanics nothing is proven to show that the multiverse theory exists, it is just essentially building blocks that describe the nature of a potential multiverse, but nothing to confirm or deny its existence or its exact properties. However, Wineland concludes with the sentiment that despite this fact, scientists alike can still relate to this theory due to an array of things such as the unexplainable phenomenon, the

evidence still present in favor of the multiverse, and the theorization of what is out there based on what is known. Thus this answers the question from before as Wineland says that the many interpretations of the multiverse is what keeps the theory moving forward since there isn't a "ring of truth" to it currently.

Conclusion

To sum it up, the multiverse is a hypothetical phenomenon that although has little to no evidence about, is a widely researched topic in science. Additionally, science fiction has portrayed the multiverse in various or different ways through various types of media and authors. In science fiction the multiverse has had components of it that have been inspired by real life science. Along with this real life science has also been inspired by science fiction about the multiverse, so much so that research in the field has increased significantly throughout the 21st century. Researching this topic with the theoretical framework of foreshadowing the future and trying to visualize the incomprehensible is important because the multiverse is a concept that sits between the lines of real and entertainment. If humans are able to visualize and understand the concept of it, then this can lead to us being able to discover what is beyond the universe and what else is out there in the cosmos. Discovering this can also potentially lead to discoveries that conflict with science and religion in essence as well. Theoretically, this discovery can be life changing for everyone. Further research can start by finding ways to increase technology that can contribute to particle research. In a scientific field it's important to lean on particle research while also maybe looking to science fiction for potential influence. As more science fiction stories about the multiverse are made, it can be easier to visualize the topic by putting together common

threads and ideas from multiple stories and sources. The multiverse is still incomprehensible, and its visualization is coming together although not there yet, however, with time this theory may come to fruition and readers may look back on this paper and science fiction as ironic that the multiverse has been there all along. Whether real or not, it's undeniable that without science fiction the widespread interest and popularity in this topic would be nonexistent.

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