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Theories and Concept of Interstellar Movie (2014) by Christoper Nolan

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A B S T R A C T

The purpose of this study was to briefly describe the theories and concepts found in Interstellar films. The film's concepts and theories became interesting for those who watched it, as many such concepts and theories were difficult to solve. The method used in this study is a qualitative descriptive study, which is the researcher analyzing the reality or events in this film. The data that will be collected will be done by watching the movie more carefully and then recording what is related to the theories and concepts that are in the discussion and then searching for a journal or video related to what is discussed. The results of this study suggest that there are several theories about the film. These are The Gravity Anomaly, The Wormhole, The Theory of Relativity of Time and Space, The Gargantua, and The Tesseract Theory. Interstellar is an interesting film to watch because the theories and concepts contained learning that could be learned.

Keywords: Theories, Concept, Interstellar

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INTRODUCTION

Astronomy is science that studies about natural universe and things sky from the various side, the natural universe keeps many mysteries that have not been solved, even on earth this is still many things not yet answered. Nature universe outside there owns a distant mystery more many have not solved. A physicist whose name is Kip Stephen Thorner uses his imagination in applying the concepts of deep physics a movie. It aims to understand physics not only presented by mathematical analysis, but it can be through film media. A film, also known as a "movie" or a "motion picture," is a series of moving images shown on a screen, usually with sound, that make up a story. The movie is gathering moving pictures accompanied by sound, so that makes it more interesting and feel live. Movies can be used as a medium for giving information by no direct or as entertainment course (Vogel, 2020). In this way, film is both an art form and a tool for social change. It can entertain, educate, or explore critical social issues. Films can make us sit up and take notice, learn about a new culture, experience a different perspective, or open our eyes to a world we know nothing about (James, von Tunzelmann, et al., 2015).

Movies have various kinds of genres, one of them is the genre of Science Fiction or abbreviated to Sci-Fi. Science fiction is a film genre in which there are studies scientific and future technological is very interesting (Latham, 2014). One of Christopher Nolan's films,

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Interstellar, became a famous film because study scientific that can say very accurate (Furby, 2015). Christopher Nolan is known as a very idealistic director where he always makes a scene in the movie as realistic as possible. Interstellar is an American film directed by Christopher Nolan with the genre of science fiction and adventure. The film, which was released in 2014, won several prestigious awards, one of which is the Oscar (2015) in the best visual effects category. Interstellar is also a physics reference which is then written in a modern physics book entitled The Science of Interstellar which was written by Kip Thorne and studied in several universities in America and outside America.

The multiple-image effect was observed only on the side of the black hole where spacetime is being dragged toward the observer, which the team concluded was because some light was being "flung" outward(Daniel, 2015). In the film industry, many screenwriters have super high imagination and creativity. Blackhole was simulated based on formula Einstein's gravity written reworked by Kip Thorne, the Professor of expert physics from the Institute of A Californian Tech Named Kip Thorne. Interstellar story is about earth becomes uninhabitable and humanity faces extinction, farmer and ex-NASA pilot Joseph Cooper (Matthew McConaughey) pilots a ship of scientists and engineer through a wormhole to find a new habitable planet in another galaxy. The synopsis sounds very simple, until you watch it and realize that this movie is not as simple as you think. Many people are challenged to watch this film because they want to try it and end up with the theory of "infinity". However, we will help the audience to understand the basic concepts, theories, to the formula used in this film to help make it easy for the audience to understand. As a recommendation and warning, watch the film that will be discussed first to avoid heavy spoilers that make the film no longer fun to watch.

In the Interstellar film, we will be introduced to many things in the galaxy, such as Blackhole, The big Wormhole which is called Gargantua and the mysterious Tesseract. In this film, there is a scene that shows differences very far time that is one hour the same as seven year. Difference distant time are caused by the size of gravity moment be near the blackhole/narrowing of the black hole space which makes the time intensity smaller. Blackhole has a tip called a singularity (Landsman, 2021). At the time a thing approaches blackhole, a thing that will feel the “spaghetti” effect because of the difference of very strong gravity Among the two adjacent points (DeCristofano Carolyn Cinami, 2012). A wormhole simply is a road shortcut for going to something very far away place (Christopher Nolan, 2014). How the wormhole works will be explained further in the next part. The sci-fi film Interstellar succeeds in making the audience imagine about the sophistication of technology and space exploration as well as the depiction of space and time, so it is very appropriate to be used to start an introduction because there are many basic principles that used to understand the concept of science, which then be able to explain that natural phenomenon others like binary code and planets in solar system. Dr. Thorne said he had almost always been able to find a way to accommodate Mr. Nolan’s ideas. Luckily, as he said, “There is a lot of leeway beyond the frontier.” At one point, director Nolan asked for a planet on which the dilation of time because of immensely powerful gravity was so severe that one hour there would correspond to seven years on Earth — an Einsteinian effect that plays a big role in the plot. (Dennis, 2014)

METHOD

Data source is the source from which data is obtained. The source of data in this study is obtained through dialog conversations in the film "Interstellar" in which there are elements related to this research, namely scientific theories about outer space and searching and collecting writings, books and other information about Interstellar films. The research method steps scientific use for look for a solution in something Theory lesson (Mayring, 2014) The tools used in data collection are books and pens to record the parts to be discussed. Data collection technique is the most strategic step in research, because the main purpose of research is to get data. Data collection is done by watching the film by paying attention to dialog and other details, noting the things that want to be discussed along with the minutes of the theory to be discussed, looking for journals or videos related to the things discussed, and presenting data based on the results of the study then drawing conclusions together. Data Analysis Techniques The data obtained from the research results will be analyzed qualitatively, where the data obtained in the field, processed and then presented in written form.

Descriptive Qualitative methods in social research are often used to analyze and understand complexand ambiguous social phenomena, such as the interpretation of theories contained in films such as Interstellar. In this study, researchers will use a qualitative approach to identify theories that are relevant to the film Interstellar. Thus, researchers can understand and interpret the messages and meanings contained in the Interstellar film through the perspective of different theories. Qualitative methods can help to understand how the theories in the film Interstellar are understood.

The data collection tool that will be used is observational notes covering important scenes in the film, the theories found, and an analysis of how these theories work.

Timestamps	Description
13:50-14:20 (The Gravity Anomaly)	The Gravity Anomaly. Researchers will conduct research on what is Gravity Anomaly.
58:40-1:01:20 (The Wormhole)	Appearance of the wormhole. Researcher will conduct research on how the wormhole works and what will happen when Cooper and the team entering it
1:02:30-1:02:50 (Theory of Relativity of Time and Space)	The Theory of Relativity of Time and Space. Researchers will conduct research on the impact of the relativity of time and space in interstellar films.
2:17:42 – 2:19:20 (The Gargantua)	The Gargantua. Researchers will conduct research on what Gargantua is and fact about Gargantua.

2:20:38-2:34:50 (The Tesseract Theory)	The Tesseract Theorry. Researchers will conduct research on what is the tesseract how does it work.

FINDINGS AND DISCUSSION

As a second warning and recommendation from the writers, watch the movie Interstellar first before reading this results table. This is due to avoid heavy spoilers and avoid confusion because you haven't watched the film.

Timestamps	Explanation
13:50-14:20 (The Gravity Anomaly)	In several scenes, Cooper notices that several books have fallen to the floor for no reason. The anomaly is explained in the film as the effect of an entity in the fourth dimension trying to communicate with humans through gravity. The effect creates a changing gravitational field that is unstable and difficult to predict. (Hackney, R. I. & Featherstone, 2021) Scientifically, it is possible that the gravity anomaly in the room is caused by changes in the gravitational field caused by environmental factors such as the presence of heavy objects nearby or changes in temperature or humidity in the room. However, in the context of the film Interstellar, the gravity anomaly is more of a fictional element used to show the effects of human interactions with entities in other dimensions. This entity is none other than Cooper himself. a few minutes before the end of the film, we as the audience will see that the Entity who is trying to communicate with Cooper's child is he himself who is trapped in the *Tesseract* dimension.
58:40-1:01:20 (The Wormhole)	The wormholes solutions represent a shortcut between the points of two parallel universes or, two different points of the same universe (Jusufi Kimet, Ali Övgün, 2017).Wormhole are shortcuts to reach very far place through a higher dimension (Kaku, 2016). Black hole is causally disconnected from the outside (Perucho & Font, 2017). In this scene it is explained that the wormhole has a way of working such as folding a marked paper at the top and bottom so that if folded it will merge. And that's how the wormhole works just as it's described. The conversation says that the wormhole shape is not a round shape, but rather a sphere shape that is a three-dimensional shape of a circle. The hole is a three-dimensional circle called a sphere. That's because the actual shape of the wormhole is four dimensions where we who live in a three-dimensional world cannot see the four-dimensional shape. In the movie Interstellar, when Cooper and his team enter the Wormhole, there is a great vibration with the ship. Even so, the vibration only lasted for a moment. After that happened they got to their destination, namely Planet Miller, a planet filled with water. A wormhole will pinch off so quickly that nothing can travel through it, unless it has “exotic matter” at its

	throat—matter (or fields) that, at least in some reference frames, has negative energy density. (James, Von Tunzelmann, et al., 2015)
1:02:30-1:02:50 (Theory of Relativity of Time and Space)	Einstein's theory known as the special theory of relativity, or simply special relativity. In his foundational paper, "On the Electrodynamics of Moving Bodies," was awarded for new ways of thinking about length and duration. He explained the special role of the speed of light by positioning that there is an absolute speed limit in the universe a speed at which light just happens to travel when moving through the universe and that everyone would measure that speed to be the same, no matter how they were moving. The dialogue tells of the theory of relativity in which time is relatively relative, as Einstein said, time will slow down even more if it approaches an object with an enormous gravitational force. Moreover, the more we move closer to the speed of light, the slower it will become. In theory, general relativity mentions that space and time no will the same in every place (Will, 2014). We have may be about 1000 10000 years for salvation of human species and by that time we should have spread out into space, and to other stars, so a disaster on Earth would not mean the end of the human race, as Stephen Hawking told BBC (Semyonov, 2018). In the movie Interstellar, this time difference occurs when they are close to the planet Miller. Why is this happening? When Cooper and his team pass through the Wormhole, not far from the planet Miller, there is Gargantua. Gargantua is what causes the time on Planet Miller to be very different from that on earth. More details will be explained in the *Gargantua part* later.
2:17:42 – 2:19:20 (The Gargantua)	Gargantua is a supermassive black hole that is the focus of the story in the movie Interstellar. In the film, Gargantua has a mass 100 million times that of the Sun and is a powerful source of gravity. The theory that underlies Gargantua's existence in the film Interstellar is the theory of general relativity put forward by the physicist Albert Einstein. According to this theory, objects with large masses, such as Gargantua, can warp space and time around them. Real-time users were limited in the sources of precise data, since only the predicted part of ultra-rapid products was available in real time (Hadas & Bosy, 2015). A Fun fact about Gargantua in Interstellar is that the visual effects team at double negative actually used equations provided by physicist Kip Thorne to create the ost accurate simulation of a blac hole ever seen in a movie. Additionally, The “Gargantua” name is a reference to a character in novel by French author, Francois Rabelais, known for his satirical and comedic writing style.

2:20:38-2:34:50 (The Tesseract Theory)	When Cooper enters the Tesseract, he feels a curved and complex network of information and time movements, and through observing and interacting with the environment, he manages to understand the messages that the entity wants to convey. In the context of the film Interstellar, the Tesseract can be considered as a fictional concept that is used to enable humans to communicate with a superior entity that masters a higher dimension than the three dimensions that we experience in everyday life. Although the concept of the Tesseract has no clear scientific basis, it does add an element of fiction and magic to the film's story.

The results explain about the kinds of theories of physics concepts in the movie interstellar, that the theories in the movie interstellar are related to physics concepts, such as the phenomenon of artificial gravity based on Newton's concept of gravity with the gravitational force categorized as a centripetal force that causes centripetal acceleration, the phenomenon of time dilation based on the special theory of relativity regarding time is relative depending on the object moving near the speed of light or being near a strong gravitational field. Although there are some imprecise physics concepts, one of which is wormholes, which is just a technical feat with digital computer effects, as the existence of wormholes is just an idea through proving mathematical equations, the movie is generally accurate enough to entertain the audience.

Has a topic that is almost similar to tesseract research with research conducted by D. Jukic and H. Buljan (2022) that is four-dimensional photonic lattice and discrete tesseract solitons. This study has something in common, namely that there is a tesseract in it and both state that the tesseract is a higher dimensional space. Although in a different context, the research results show that until now the tesseract is still an unreal concept. There is a difference in this study, namely the tesseract in the research of D. Jukic and H. Buljan (2022) analyzes how the tesseract or 4d which has a higher dimension can become real in the context of a photonic lattice. Whereas in this study, it only discusses the explanation of the part of the movie related to the concept of tesseract so that readers can understand the basis of what the concept of tesseract is and readers can understand the storyline contained in the movie interstellar.

Research from R. I. Hackney and W. E. Featherstone (2003) on the topic Geodetic versus geophysical perspectives of the 'gravity anomaly'. This topic is the same as the topic that our researchers discussed, namely regarding gravitational anomalies. Gravity anomaly researchers from R.I. Hackney and W.E. Feather Stone (2003) it's more to the difference in acceleration due to gravity caused by the mass of the earth. For example, if there is a difference in the amount of mass below two measurement points, then the estimated gravitational acceleration at those points will be different, and this discussion is more about the basic theory, different from our research results that the gravitational anomaly refers to entities from the 4th dimension or aliens which can create gravitational fields that are unstable and difficult to predict.

Having the same topic with the studies done by Atabik Ali Mubarok (2022), which explains the theories contained in the movie interstellar. Based on the results of the research, 2 things were found as the main problem in this movie, namely gravity and relativity. These two things gave birth to several things such as black holes, wormholes, singularities, and worlds with higher dimensions. We must remember that even when having perfect orbit and clock corrections, we may be unable to determine the position when the orbit and clocks are temporarily unavailable (Kazmierski et al., 2020). It is said that the scientific concept shown

in this movie is designed according to existing theories. Meanwhile, this study explains the storyline and the basic theoretical concepts contained in the movie Interstellar and states that there are several theories that are only fictitious to support the storyline, one of which is the wormhole theory

CONCLUSIONS

Interstellar is a very interesting film for those people who like fiction scientific because the study scientific in this movie is so realistic and able to calculate. this movie invite viewer to think that time it's relative. this movie will make viewers confused and wonder why can occur as that so that need at least watches twice to understand the film. Interstellar can Become an ingredient very interesting teaching, both in school and in lectures. Interstellar is already many studied by people even Becomes a scientific reference.Based on results research, found two things to be problem main in this movie is gravity and relativity. The second Case gives birth to several Cases as blackhole, wormhole, singularities, and worlds with higher dimensions. Draft scientific display in this movie made based on existing theories. With no direction, this movie reminds people for more nurse Earth with the good because at the time this is a fact Earth the more no healthy.

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