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**Distant Stars Become Future Homes: The Close Relationship of *Interstellar*
Between Hard Science-Fiction and Spectacle**

**by
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Literature and Language

East Tennessee State University

Undergrad Honors Thesis

Abstract

Hard Science-fiction shares a close relationship with the element of spectacle. This is especially apparent in Christopher Nolan's *Interstellar* (2014), a film based in realistic science and emotional appeal. Nolan makes use of creating a team comprised of creative minds with different backgrounds. This includes theoretical physicist Kip Thorne, co-writer Jonathan Nolan, and composer Hans Zimmer. Together, the four develop a film that focuses on three main facets of science: time dilation, black holes, and dimensions. Incorporating these elements based in the historical world gives *Interstellar* its classification as hard science-fiction, a genre based more solidly in realistic science than classical science-fiction. Thorne serves as an executive producer and advisor to all matters scientific, Zimmer composes the score to accompany and intensify the moments of spectacle, and the Nolan brothers serve to create the plot behind *Interstellar*. The film's spectacle can be seen throughout, notably in the "Miller's Planet" and "Gargantua" scenes. Nolan also incorporates Welsh Poet Dylan Thomas's "Do not go gentle into that good night" to exemplify the film's theme of perseverance against increasing odds. It is through these elements that *Interstellar* serves itself as an exemplary film for showcasing the relationship between the nature of hard science-fiction and spectacle.

Acknowledgments

While this is not an incredibly large project, it's still one that required much work, enough to reasonably consider a milestone in my academic career. This being my first major work that I've done, there are many people to thank for their supportive roles throughout the process of not only this thesis but also my undergrad career. I've had the luxury of being supported in all of my educational decisions by my loving mother, Jennifer Davis. Were it not for her and her unmatched encouragement, my college career would never have reached the point that it has now. My passion in astronomy comes from gazing into the night sky with my Northeast State Community College mentors, Robin Byrne and Adam Thanz. Many late nights have been spent asking questions and pondering the Universe with this insightful duo. My love of poetry was fostered by Department Chair Daniel Westover. His ability to bring written words to life remains the greatest of its kind. It is through my patient and caring thesis mentor and thesis reader, Matthew Holtmeier and Chelsea Wessels, that I am able to convey such passions on paper. Their education and knowledge proved to be unbeatable throughout this entire undergrad thesis process. ETSU Associate Dean Karen Kornweibel allowed me to vent (on several occasions) concerning my stress and fear of pursuing higher education. Her reassuring demeanor was always a welcomed counter to my anxieties. Were it not for this group of people, and many more, I certainly wouldn't possess the mindset I do now.

“Do not go gentle into that good night. Rage, rage against the
dying of the light.”
– Thomas, “Do not go gentle into that good night”

Introducing *Interstellar*; its Nature and its Premise

The nature of cinema has always possessed a dual existence of incorporating real-world and fictional elements. Film offers writers an open palette of both artistic and scientific elements to choose and work with causing boundaries between these two subjects to become blurred, hence the existence of genres such as science-fiction and science-fantasy. The two terms exist as oxymorons in themselves, yet even with their juxtaposition, the contrasting elements blend together to create a new setting where one can immerse themselves in the depths of physics and imagined science simultaneously. Evidence of this lies in the works of Christopher Nolan and his film, *Interstellar* (2014). Distant stars become potential homes in which the works of Dylan Thomas guide the film’s theme of unrelentingly “rag[ing] against the dying” of humanity and its impending starvation on a world that no longer houses the means to produce life. A parallel can be seen running between both arts and science as Nolan collaborates with astrophysicist Kip Thorne and musician Hans Zimmer that serves as a catalyst for inspiration to characterize science-fiction not as just a classification but as an attainable, somehow possible reality in which humanity transcends the knowledge of the historical world. *Interstellar* serves as a representation of the notion that Nolan breached the dividing walls between art and science by incorporating time-dilating gravity and space-warping black holes with Welsh poetry and a score based in giving sound to human empathy and compassion. This effect led to the production of a film that engages directly with contrasting subjects, allowing Nolan to establish commentary on the role of a father’s love with respect to the realism of the historical world through the film’s plot.

Interstellar's central conflict sprouts from an issue with Earth's unsustainable viability in the modern year of the 2010s. Similar to the first Dust Bowl, Earth has been over-farmed, and resources are quickly spreading thin. Okra is approaching its last harvestable season, leaving corn to be the only growable crop. Cooper, who is a farmer during this food catastrophe, was previously a test pilot for NASA with a background in engineering where he fell victim to a crash due to faulty autopilot interference. Having moved on from his piloting stage in life, Cooper intends on raising both of his kids with the help of his father-in-law, Donald, played by John Lithgow (Cooper's unnamed wife died due to a cyst on her brain). However, odd events begin occurring at the farmhouse where the family lives as books begin falling off shelves in distinct patterns. At first, Cooper's daughter, Young Murph (played by Mackenzie Foy), believes it to be the doings of some apparition or ghost. Cooper, having a background in engineering, employs the scientific method of developing a hypothesis and putting it to the test. Teaching this way of thinking to his daughter, Young Murph decides to test out her prediction. After some automated farm machinery begin to have issues with their navigational settings, it's determined that gravity is the cause behind the occurrence of these unusual events. This leads Cooper to decipher a pattern of empty spots on Young Murph's bookshelf from the fallen books to determine a set of coordinates where he will eventually venture to, and consequentially, rejoin NASA in an effort to work against the ever-increasing threat of humanity's extinction. This journey takes Cooper across both time and space as he, along with his team, explore potentially viable planets to find humanity's new home.

Approaching *Interstellar*; the Crew behind It

Interstellar combines topics such as genre, collaboration with science, and commentary on issues present in the historical world such as environmental collapse. Each of these aspects

work together to provide a film that shares a close bond with hard science while retaining its ability to incorporate imaginative elements. The production behind a film such as this relies heavily on collaboration among many minds of varying backgrounds. Because of the emotionally charged focus on a father/daughter bond and the desire from Nolan to retain scientific accuracy as heavily as possible, established musician Hans Zimmer and astrophysicist Kip Thorne were both recruited to devise an ambiance based both from and on the film's theme; this creative pairing allowed the creation of a realistic environment in which Nolan's film could navigate its plot based in both science and spectacle.

Christopher Nolan served as both a co-writer and director for *Interstellar*. Nolan began his film career early in his life while still a child by "using his father's Super-8 camera to make shorts... [after being] influenced by George Lucas's *Star Wars* trilogy and by the immersive dystopian films of Ridley Scott" (Albert 2), the most famous of Scott's films being *Blade Runner* - a sci-fi film that shares a sense of environmental collapse with *Interstellar*. Given Nolan's early fascination with science-fiction, several of his films have explored cerebral topics such as *The Prestige* (2006) and *Inception* (2010), both of which involve parallel universes. Given this previous work, it's only natural that one of his later films followed suit by possessing a focus on equally mind-boggling scientific concepts, particularly those based in historical observations from astronomy and physics, coupled with a plot surrounding spaceflight.

Jonathan Nolan, the other co-writer for the film, is the younger of the two Nolan siblings. While still heavily involved in the film industry, his role typically involves laying the groundwork for screenplays and narratives. J. Nolan created the first draft of the screenplay for *Interstellar*, originally intending for Spielberg to take the reins on directing the actual film. However, for unspecified reasons (the ones that are specified are based purely in speculation),

Spielberg sat on the script for several years without making any moves leading the Nolan duo to take matters into their own hands to produce the story J. Nolan had imagined (with some tweaking from the other brother). In addition to having co-written *Interstellar*, the Nolan brothers have also collaborated on prior films, both in science-fiction and action, such as *The Prestige* (2006), *The Dark Knight* (2008), and *The Dark Knight Rises* (2012), each of which also contain elements heavily based in spectacle.

Theoretical physicist and astronomer Dr. Kip Thorne was asked to perform in an advisory role on all matters related to astronomy and astrophysics in an effort to keep *Interstellar* as close to reality as possible. Thorne possesses a working knowledge of soil science, arguably an element as equally as important in the film as astrophysics given the heart of the conflict is based in farming grounds becoming infertile, in addition to his astronomical background. Thorne describes the working relationships of branching sciences of the Universe in the following manner: “astronomy as a subfield of physics, the role of mathematics as the language of physics, the beauty of Einstein’s relativity, and the power of physical laws to explain the Universe” (Thorne 6). This mindset coincides with *Interstellar*’s focus on the reasoning for its depicted physical laws along with its artistic depiction of its scientific elements. Thorne’s background of studies was the ideal foundation for utilizing three complex astronomical subjects: time dilation from gravity, what happens inside a black hole, and gravitational effects through time. Thorne and the Nolan siblings collaborated over what elements were plausible and what phenomenon were simply impossible due to the physics of nature forbidding it.

To accompany his emotionally charged film’s theme surrounding familial love, Nolan chose to partner with world-renowned composer, Hans Zimmer. Zimmer is a German-born musician who has orchestrated scores for over 100 films, including *The Dark Knight Trilogy* and

Inception. Zimmer's composition of *Interstellar*'s score is unique in nature due to his initial, unnamed piece (which would become the groundwork for the film's main theme) being written prior to *Interstellar*'s inception. In "The Oscar-winning Composer," Tim Appelo wrote "[Zimmer,] in one night...wrote a four-minute piece with piano and organ" (3). Zimmer is quoted as describing his inspiration the thematic feel of the theme; "I really just wrote about what it meant to be a father" (Appelo 3). By basing the theme on this emotional underbelly, both Zimmer and Nolan continued to build from the pre-established pathos in both the music and writing, alike. In addition to *Interstellar*, Zimmer has also composed the score for *Blade Runner 2049* (2017), a sequel to Ridley Scott's original film which influenced Nolan's passions. The contribution of Hans Zimmer's musical score allowed for *Interstellar* to retain a strong emotional underbelly of its plot alongside its sturdy foundation in scientific realism.

One can clearly determine that backgrounds serving music, filmmaking, and physics differ greatly in both academic stature and studies. Though, were it not for such diversity in mindsets, *Interstellar* would fail to bridge both art and science together in a time-warping, parental-loving manner. The involvement of such professions together lead to a balanced approach of artistic style and scientific realism in the film's production.

The Thematic Element and its Expression through Poetry

Interstellar's plot is both vast in its power-of-love theme as well as its astronomical setting. Nolan made no attempts to simplify the film's plot as scenes are based everywhere from a farmer's home to a foreign planet with time-crunching gravity. Additionally, Nolan's conveying of the role of love in time and Space lies within the roots of the film's elements, particularly within Zimmer's musical score and the use of poetry by Dylan Thomas. This causes

the plot of *Interstellar* to be relevant to the historical world in both human empathy and geological preservation.

Dylan Thomas's "Do not go gentle into that good night" plays a key role in explaining the premise of the film's plot through its repeated line of "Rage, rage against the dying of the light." The poem's introduction into the film is positioned alongside the Space-faring crew's final preparations for setting off to find humanity a new home. On screen, Cooper and his team are communicating to one another while performing system checks. Off screen, Professor Brand (the father of Amelia Brand), reads the first two stanzas of Thomas's poem. It's noteworthy that only the first two stanzas are read, as this coincides with the "beginning" of "Do not go gentle," just as *Interstellar*'s climactic plot (venturing through a wormhole into a new galaxy) is beginning as well. The final two lines read aloud from Professor Brand are "Do not go gentle into that good night,/Rage, rage against the dying of the light." While both the plot development and the poem's stanzas are in their respective beginning stages, the premise of these two lines, do not allow yourself to die easily but rather fight against the loss of your life, also serves as the establishing lines for the overarching plot. This scene provides context for the film's theme through Thomas's work.

With elements such as poetry and science, the narrative balances realistic characteristics such as the nature of ecology while enforcing the nature of a father's love. The incorporation of these traits can blur the classification of genre. Given that *Interstellar* does exactly that, obscuring the traits of general science-fiction, it's reasonable to question where the film lies on the genre spectrum.

The Position on the Science-Fiction Spectrum

Classifying *Interstellar* as simply science-fiction fails to completely represent the nature of the film. A film such as James Cameron's *Avatar* (2009) is classified as science-fiction, even though the premise of the setting and conflict are both based in fantastical realities. Contrast this with *Interstellar*. The viewer plays witness to a matter of space travel with relevance to real time as well as real-world phenomenon such as gravitational time dilation based in actual, provable science. Because of this, there lies a need to further the distinction beyond the generalization of classical science-fiction. This leads us to the subgenre of hard science-fiction, one of which *Interstellar* fits neatly into with its scientific realism.

The term "hard science-fiction" was initially coined in 1957 by P. Schuyler Miller to describe John W. Campbell's *Islands of Space*, though Miller neglected to provide an accompanying definition. It wasn't until a later review of Hal Clement's *Natives of Space* that the hard sci-fi pioneer would elaborate on the term's meaning. According to Clement, hard sci-fi is a genre "in which worlds and beings are constructed out of chemistry, physics, and ingenuity" (Westfahl 17-19). This became the generally accepted definition and serves as the basis for which we define films such as *Interstellar* today. As with most genres, definitions of hard sci-fi are continually evolving with new examples

Other science-fiction pictures have included qualities that deserve recognition outside that of general science-fiction. For example, Dennis Villeneuve's *Arrival* (2016) has a plot based around a fictional alien race with the capability to communicate via the implementation of visions of the future into the main character's memory; this is certainly not what's considered realistic science. On the other hand, the linguistics behind the film's establishment of a line of communication between the alien species and humanity is based solidly in real language studies.

This raises the question of whether or not *Arrival* then qualifies itself as hard science-fiction, or perhaps some hard sci-fi/fantasy hybrid. I would argue that his matter of utilizing real-world science is predominant enough in the production to justify a specialized classification because of its significant impact on plot elements. *Interstellar* finds itself in the same position due to its use of astronomical concepts of black holes and gravitational time dilation as the catalyst points for the plot's progression. Of course, simply involving Space in the setting of a film's plot isn't enough to separate it from typical science-fiction.

Hard science-fiction goes beyond foreign planets, however. Were this the case, *Star Wars* (1977) would be considered as one of the most prominent films of the genre that just also happens to involve space magic and octopus-kin creatures that know how to play brass instruments. To define something as hard science-fiction, distinctive qualities such as realism and attention to scientific accuracy must be present. In *Hard Reading: Learning from Science Fiction*, Tom Shippey defines the needed elements as a "class of prose narrative treating [a] situation that could not arise in the world we know, but which is hypothesized on the basis of some innovation in science or technology" (22). What is the world we know, and how does it change in Nolan's film? We live on a planet traveling through Space which contains almost infinite resources on a finite timetable. In *Interstellar*, this same world exists, however the finite timetable takes precedence. Failing crops and an imminent hunger crisis have created the need to find another world where life can continue by using innovative science and technology to search for a new world. In this case, the two come in the form of wormholes and spaceships capable of sustaining life during long-distance travel. The story sets itself "around human beings, with a human problem and a human solution, which would not have happened at all without its scientific content" (Shippey 22). This blending of the human element with innovative technology

defines the film as hard science-fiction by being set in a world that meets the standards of containing an issue requiring a solution using hypothetical methods not present within, as Shippey calls it, “the world we know.”

There’s an additional element to be considered in this debate of hard sci-fi versus general science-fiction. The emerging field of science communication incorporates the traits of both a writer and scientist simultaneously, much like the production of *Interstellar* alongside other sci-fi films. Science communication is based on the ability to articulate hard-to-understand concepts in a form that can be understood by a common reader. In a manner of speaking, hard sci-fi inadvertently plays a role in this field by incorporating storytelling with realistic scenarios, at least realistic relevant to the research used to create its plausible scenario. The main goal of any form of communication is to ensure that the intended audience understands the message of whatever topic is being expressed. When one combines this goal with film’s ambition to captivate an audience, a viewer is simultaneously being entertained while learning to apply scientific fact to abstract thought. This indirectly creates the role of mediator between two fields with polarized traits causing the two subjects to become a single stream of thought, thus cementing the mediating role of hard sci-fi in the discipline of science communication. This same concept applies to *Interstellar* due to the film’s basis in realistic science with a focus on a fictional narrative. The film naturally creates the effect of imploring a viewer to explore a topic initially foreign. In an English major’s case, this would be astronomy, whereas a physicist might wish to investigate the poetic component. It is through this discrete suggestion in *Interstellar* that curiosity into both realms is naturally stirred from their metaphorical slumbers with newfound ambition to study subjects alien in nature relative to the viewer.

Interstellar challenges elements of traditional science-fiction storytelling through the collaboration of a musician, two writers, and an astrophysicist. The film's production represents the culmination of varying backgrounds and passions. While that artistic element of collaboration among varied fields is the driving force that inspired initial work for the film to be produced, it is the scientific foundation that propels the fictional story into reality. The film also invites consideration of the traits of science fiction film as a whole, as well as acknowledging the combination of polarized fields needed to produce such an effect. Not only must the scientific component be examined but also the relationship it possesses with spectacle as well.

Interstellar and its Science: the Three Main Facets

Interstellar utilizes three primary areas of astronomy and physics: time dilation, black holes, and dimensions that go beyond the three we're familiar with on a day-to-day basis. The first, time dilation (the process of experienced time being extended or shortened relative to gravity), is a complex phenomenon involving intricate equations and a plethora of variables, especially when adding in the gravitational presence of a supermassive black hole. The second, black holes themselves, are more theoretical in nature, given that we cannot truly claim to know what goes on inside of one. The third and final facet is the exploration of dimensions past the third, an entirely theoretical field. Even now, we can only speculate that the fourth dimension might be time, and *Interstellar* goes as far as to mention the fifth being a realm in which time is a physical construct. Since all three of these elements are heavily based in hard science, Christopher Nolan chose to employ the invaluable knowledge of astrophysicist Kip Thorne with specific regard to these aspects of the film. The representation of these elements establishes *Interstellar*'s focal point in hard science-fiction by allowing the viewer to simultaneously be compelled by spectacle while still retaining respect for its accuracy of such concepts.

Time Dilation

Time dilation is a concept not truly “felt” by those experiencing it. There’s a reason we refer to Einstein’s field of research as relativity. The title defines the field explicitly; what is being studied is relative to the subject experiencing it. The phenomenon is one that’s naturally difficult to visually represent past that of tables and charts of relative data. For film, this comes down to a matter of setting and camera placement to convey to the viewer that something is straying from the course of expectation. This is in addition to ensuring the concept is understood by the viewer. For *Interstellar*, both of these feats are performed by Nolan with the assistance of Kip Thorne.

Time dilation is an effect that can be as small as a few milliseconds or as large as a few years. To understand the nature of time dilation, we must first establish the effect that gravity has on time. Time is a relevant construct, as proven by Albert Einstein. What this means is that time is dependent on other contributing factors, such as gravity, which possess the capability of dramatically altering any resulting calculations made in an effort to determine the difference between time on one point as opposed to another. The relationship between time and gravity goes as follows (when referencing the relative effects had on an affected person): the stronger a gravitational force is being exerted on someone, the “slower” time will be for them compared to someone who is experiencing what we would consider to be a “normal” gravitational force (like Earth’s). For example, GPS satellites must account for time dilation on a daily basis since their orbit around the Earth possesses a weaker gravitational pull than the surface. Clifford M. Will states in his “Einstein’s Relativity and Everyday Life” that the gravity experienced by satellites orbiting “is four times weaker than that on the ground... [resulting in] a GPS satellite clock advanc[ing] faster than a clock on the ground by about 38 microseconds per day” (6). While 38

microseconds doesn't seem like enough to create a drastic difference, it's important to remember that this is per day, meaning that were we to negate this dilation over the course of several years, our GPS satellites would eventually become out of sync with real world time potentially leading to incorrect road maps and hazard warnings. It's exactly this concept that comes into play regarding the recurring issue with time in *Interstellar*, which underscores the theme of perseverance in the face of an ever-approaching demise for Earth.

For *Interstellar*, time plays an important role in not only plot development but also in scientific realism. Shortly after about a third of the way through the film, Cooper and his team are tasked with landing on a potentially viable planet referred to as "Miller's Planet." The issue with this potential home, however, is that it's orbiting a supermassive black hole, conveniently called "Gargantua." Since the planet is so close in proximity to Gargantua, time is dilated to the point of roughly 1 hour on Miller's Planet being 7 years on Earth. Because of this, Cooper implores the team to move with haste to quickly determine whether or not the planet can sustain life so that they can minimize the effects of time dilation. After catastrophic events transpire, the crew finds themselves temporarily trapped, unable to escape the crippling effects of gravity. If one were to compare these circumstances to that of something in the historical world, a 7-year difference certainly seems drastic in comparison to 38 microsecond dilation of a GPS satellite. This calls into question the validity of such a phenomenon being plausible, especially given that the film's plot rides on the crisis of a father returning to his daughter before the Earth reaches an uninhabitable state.

Christopher Nolan turned to Kip Thorne to discuss the plausibility of having time dilated by gravity to the extreme point of 1 hour being equivalent to 7 Earth years. Initially believing the idea to be impossible, Thorne argued against the concept until he pondered it overnight and

worked through various equations to determine what circumstances would need to be present for such a phenomenon to occur. Thorne eventually determined that “[Gargantua would need] to be spinning very fast,” in addition to the planet, “in the necessarily close, stable, circular orbit to not be ripped apart,” as quoted in his interview with Lee Billings for the Scientific American Blog Network (9). The consequences of such gravitational forces are explained in Kip Thorne’s *The Science of Interstellar*, a book entirely about how each scientific component of *Interstellar* works. Thorne explains that “Miller’s planet is subjected to enormous tidal gravity, so enormous that Gargantua’s tidal forces almost tear the planet apart. Almost, but not quite. Instead, they deform the planet... it bulges strongly toward and away from Gargantua” (Thorne 163). Essentially, this means Miller’s Planet is ovular in shape as opposed to the seemingly perfect (in a visual sense) roundness of Earth. An additional note to be made about Miller’s Planet is that its surface is entirely covered in water, hence the enormous waves caused by the strong tidal forces. To depict this type of environment accurately, Nolan needed a setting that possessed qualities capable of simulating an ever-stretching horizon with intense gravity.

Nolan chose to film the scene in Máfabót, Iceland, where an open body of shallow water with a view stretching into the horizon provided an ideal setting to manipulate cinematically. Having such an open, shallow body of water allowed for intense gravity to be easily depicted through Cooper’s team stumbling through the ocean. This was accomplished via a bird’s-eye-view camera positioning during the establishing shots. In these sequences, Cooper and his team’s “Ranger” (the smaller ship used for planetary landfall) is seen landing, causing ripples in the shallow water that stretches to each corner of the screen. Additionally, the uncluttered landscape allowed for the seamless inclusion of massive waves added through CGI. By using a real-world location as opposed to a set, a natural ambiance was more easily established, creating

authenticity for the scene. The massive waves covering the entire sightline of the horizon created a sense of urgency necessary for this scene. The location is crucial to the urgency of the film's plot, and by utilizing a natural location such as Iceland, artistic depictions of massive waves were easily introduced into the scientifically based sequence.

Time dilation is a critical feature to the plot of the film. Because of this, both the integrity of the science used, and the practicality of the mise-en-scène must both be taken into account. Nolan not only ensured he had the ideal environment for depiction, he also collaborated with Thorne on the matter to ensure accuracy. While serving as a plot-progressing element, time-dilation of an alien planet requires a believable reason to exist within the film in the first place: a black hole.

Black holes

Likely the most fantastically focused element of the three primary scientific aspects of the film, black holes are real, naturally occurring phenomena in various portions of space, primarily in galactic cores (including our own). Usually coming in the form of supermassive black holes, these large, gravitationally heavy pools are so incredibly strong in their gravitational pull that even light cannot escape their grasp. It was only recently that one was even photographed for the first time. They are certainly unique in their appearance, visible in the appearance of warped light going around the event horizon (the zone in which light cannot escape). This appears as a black hole (literally) surrounded by light warping to seemingly encompass the shape of the actual black hole. For reference, see the image (Figure 1) below.

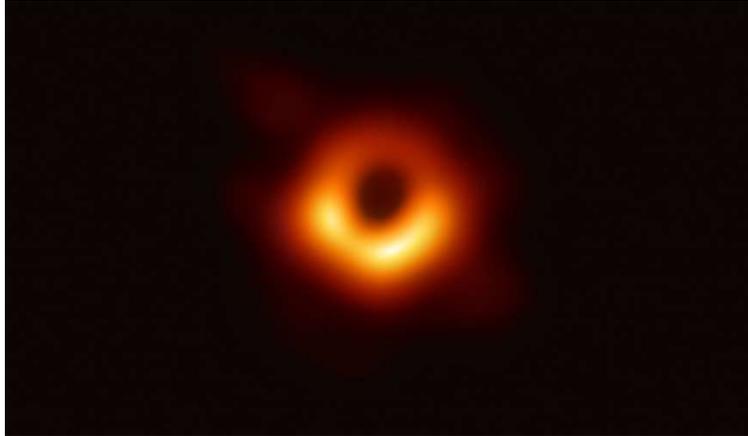


Figure 1. Event Horizon Telescope collaboration et al.

In other words, imagine a giant vacuum in which all surrounding matter, including light, is pulled into a dark mass that's only visible because of the warping of surrounding light, usually resulting from the death of a high mass star (Dunbar 1). Addressing a particularly confusing concept, one might ask *how is light reaching Miller's Planet then if black holes allow none to escape?* The answer is somewhat paradoxical in that matter sucked into a black hole doesn't escape but rather eventually gets emitted as Hawking radiation. This is how the sky can be so bright upon Miller's Planet.

To create a plausible representation of a black hole in *Interstellar*, several factors, such as the event horizon, required careful construction. Gargantua is the visually depicted black hole in *Interstellar* used to serve as a plot device for creating a massive time crunch in Cooper's mission. Its proximity to one of the planets pinged for viability sets cause for the urgency in landing, collecting the data, and leaving the planet's gravitational pull as quickly as possible. Additionally, Gargantua's singularity, the point in the center of the mass, later serves as a setting for a scene in which Cooper alters the literal fabric of space and time; at this point it becomes apparent that the hard sci-fi of the film loosens its strict adherence to known natural laws for the

theme of the film to develop. *Interstellar* utilizes this flexibility in adherence to depict Gargantua in a manner capable of being captured in a single shot.



Figure 2 Gargantua w/ Miller's Planet

Looking at Figure 2, Gargantua can be seen in the background of the frame behind Miller's Planet. The black hole is noticeably able to fit within a single shot, something Thorne has spoken against the plausibility of. The decision to include the entirety of the celestial body reinforces the spectacle of its appearance in the film. In introducing one of the first "full body" shots of Gargantua, the viewer is provided with a point-of-view shot from the Ranger as it approaches the orbit of Miller's Planet. In this particular sequence, one can see just a fragment of the massive planet covered in water, along with several storm clouds in its sky. Not only are we able to bear witness to the vastness of the new setting, we can also determine that the orbit from the black hole is quite a distance off, given that we can see the entirety of it. It's reasonable to consider this might have been done with reinforcing the necessary circumstance of Miller's Planet requiring a far distance of orbit from Gargantua to be scientifically plausible. Regardless of whether the position of the black hole in the sequence is for spectacle, scientific accuracy, or both, its recurring importance to the plot (as it later becomes a brief setting for Cooper) of the film makes it a significant element of hard science fiction. As for the work needed to cultivate

such a device, Nolan collaborated once more with Kip Thorne to determine the specifics of what qualities would be present in such a scenario.

With black holes, if the mass and rotation speed are both known, then all other properties can be determined. This is important because without such values, it would be impossible to determine any necessary qualities to realistically depict Gargantua. Thorne explains it as, “It is as though knowing my weight and how fast I can run, you could deduce everything about me: the color of my eyes, the length of my nose, my IQ” (Thorne 57). Using the properties of Miller’s Planet (its created mass and time dilation), the mass and rotational spin can both be determined for Gargantua, leading Thorne to create the devices necessary for the setting. As for the effects this has on the film itself, the narrative depends on nature’s laws as a starting point to create a believable setting where the viewer can more easily comprehend the severity of the conflict. We see a pattern emerging of creating authenticity for the viewer to be able to empathize with the on-screen characters, similar to the qualities of the setting of Miller’s Planet.

Dimensions

Interstellar utilizes two forms of travel: interstellar and interdimensional. While both involve traveling from within a specified body of universal order, there’s a key difference in the verbiage. The former, stellar, refers to traveling between the stars, galaxies, and all other celestial objects. The latter, dimensional, refers to traveling between the four known dimensions: length, width, height, and time. Each of these are self-explanatory in the name, however *Interstellar* theorizes a fifth dimension, one in which time becomes a physical construct. This materializes toward the end of the film during a scene in which Cooper begins to physically interact with what’s referred to as the “Tesseract” (see image below).



Figure 3 The Tesseract

In this shot, the camera is placed below Cooper while being tilted upward. From this view, we can see that he's interacting with the bookshelf, peering through to the other side, which reveals his daughter Murph's bedroom. The light peering out from the shelf covering Cooper in a glow is actually the sunlight coming into Murph's room. Surrounding Cooper, we see what appears to be stretched lines of light that almost match the color palette of the surrounding bookshelves, suggesting that the Tesseract that Cooper is interacting with is, in fact, an entire representation of Murph's bedroom. Each bookshelf denotes a different time stamp. In this manner, time becomes a physical dimension, one that can be interacted with by Cooper. To address this type of plot device, Thorne leans on the concept of dimensions to explain how such an occurrence might look if it followed modern physics.

In his book, Thorne describes the necessity of time as the fourth dimension through the example of establishing lunch plans with a friend. Not only is the *where* established (which utilizes the three dimensions we know) but also *when*, thus proving the need and relevance for time (Thorne 185). In regards to *Interstellar's* "bulk" realm, the plane where the fifth dimension resides, Thorne considers it possible for its existence, however we have yet to arrive anywhere

near such conclusions. Kip states, “The bulk is real if it can influence things we measure” (Thorne 187). While subjects such as “superstring theory” utilize the bulk to reconcile quantum physics, we have no real evidence of its existence. In *Interstellar*, it exists as an element in which the setting of Gargantua’s singularity can become reality for the viewer. Referring to the stacked effect present within the Tesseract, this enables both the film’s characters and its viewers to be able to comprehend the manipulation of time as it would appear to our perception.

The incorporation of scientific components such as time dilation, black holes, and dimensions not only appeals to hard science-fiction buffs but also develops the complexity of *Interstellar*’s plot. Collaborating with Thorne allowed Nolan to ensure the plot wasn’t derailing from reality, even as it moved into more speculative, and spectacular, territory.

The Spectacle of *Interstellar*

Science-fiction is a film genre based in the visual appeal of spectacle in reference to whatever semi-imaginary scientific subject is being exploited. This could come in the form of massive cube-like structures designed to collect and process all of Earth’s water for transport (think of *Oblivion* (2013)), or it could be something on a smaller scale like the mechanoids with their generic resemblance to humanity in *I, Robot* (2004). Why is there such a close relationship between spectacle and the science fiction film? Cameron Johnson explains that “if a film ever inspires [him] to change the world, it will be a wondrous science fiction film full of ambiguous imagery and magical diversity, not a drama with completely believable elements” (8). Including elements of “ambiguous imagery” suggests inspiring wonder and curiosity into the why’s and how’s such a thing could exist. It is because of this, as Johnson points out, that a viewer feels lasting effects after witnessing something surreal in appearance. For *Interstellar*, this comes in its Space-warping spectacle and its foreign planet settings.

Being a film set primarily in Space travel, the canvas is almost limitless for storytelling and set design. In our current age, humanity has never set foot anywhere past Luna, our moon, so there is no historical reference for the realities of experiencing a swell on an alien planet in a foreign galaxy, much less a solar system. Sure, we have telescopic imagery of distant horizons equipped with seemingly Earth-like bodies, but this is the extent. Applying this concept to *Interstellar*, Nolan exploits the imagination of the mind in correspondence with its rational experience. For an example, we can consider the waves present on Miller's Planet. In this particular scene, a sequence of shots provide a medium close-up/point-of-view perspective as Cooper makes visual contact with the wave. The tilting of the camera upwards to the wave's crest takes a full 7½ seconds. Attention is *meant* to be drawn in an elongated, dramatic fashion towards the massive scale of a real phenomenon in a fictional (although plausible) setting. Immediately, as viewers, we are on the edge of our seats waiting in helpless anticipation as we watch a small crew of people struggle to escape an aquaphobe's nightmare. Couple this visual element with Zimmer's score of "Mountains" becoming increasingly louder, reaching its climax right in the middle of Cooper's first glimpse of the incoming wave. The bass of the music intensifies, as if to replace the feeling of the wind rushing down the water. We *feel* the wave. The auditory/visual element gives *Interstellar* its commanding attitude of demanding attention be brought to its spectacle. There is nothing else on screen but the wave engulfing the widescreen picture in a theatre. The scene is undoubtedly one of the most memorable from the film for these very reasons. However, there's an important distinction to be made regarding the use of spectacle and the reliance on it.

What's clear at this point is the relationship with spectacle that *Interstellar* shares with science-fiction. The film is certainly pleasing to look at aesthetically, but its foundation isn't

built upon visual appeal. Seed explains science-fiction as having an “emphasis [on] dramatic action, a markedly wondrous *mise-en-scène* that defamiliarizes this world as it envisions others, and a foregrounded use of special effects” (261). It’s been established that *Interstellar* presents a “wondrous *mise-en-scène*,” through the use of special effects, however, Nolan takes a particular route with his directing that fails to rely on “dramatic action.” As Naeye puts it, “there are no rock ‘em, sock ‘em battles with aliens” in the film (11). Instead, storytelling from a scientific perspective takes precedence with both a compelling and relatable conflict.

Coming Full Circle

In a film such as *Interstellar*, I find it worth questioning why a director would combine elements such as spectacle, science, and a father/daughter relationship, given their distinct difference in roles, to tell the story of a future ecological collapse. In the case of Nolan, he clearly began with the foundational theme of parental love, hence his method of pitching the theme to Zimmer without elaborating on the actual premise of the film’s setting and environment. Nolan wanted the film to be centered on Cooper and his mission of not only finding a new home for his daughter but also returning to her with time to spend together. A father wanting to get home to his kid might be relatable for many parents, but this premise alone doesn’t captivate an audience. This suggests the significance of spectacle; Nolan creates a world based on our own with qualities only seen in paintings thus far, such as Gargantua with its warped band of light. We share the moment with Cooper as he gazes in horrifying awe towards a massive wave that stands in the way of his returning to Murph. We feel the urgency to stumble through shallow water with a weight-crushing gravity back towards our only method of getting home. And, as I have argued, what sells this spectacle is its believability because of its basis in real science. We know that time is dilating quickly because it’s happened in reality. We’ve felt

momentum and inertia, so we clench our seats as we watch Cooper fly back into his seat as the *Endurance* rounds a black hole. These elements of familial love, spectacle, and realism all are necessary when considering the story that Nolan wants to portray, hence his bringing them into fruition through having each parallel one another in the film.

The role of finite time and resources are reflected in *Interstellar*'s plot and setting, an ever-increasingly barren planet quickly reaching its end of producing life-sustaining qualities with a species in desperate need of a new place to call home. Dylan Thomas's words, "rage, rage against the dying of the light" echo in both the film's dialogue and the main character's actions throughout the film. Upon learning of Earth's impending fate and its impact on his daughter, Cooper does not "go gentle" into acceptance of death. Instead, he "rage[s] against the dying of the light" through embarking on a mission that will take him across time and space in hopes of ensuring more time with his daughter, Murph. This poetic plot comments not only the role that humanity plays in its own preservation but also the importance both time and love possess in the historical world. It's through scientific realism and artistic expression in *Interstellar* that Christopher Nolan speaks to the role and responsibility of a father to his daughter and the world around them.

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