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GLOBAL ECOLOGY AND *INTERSTELLAR*

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Abstract: The complex relationship between man and his environment has undergone several changes over the centuries. The first part of this article exploits and exemplifies contemporary attitudes to the fundamental ecological problem of the world – global warming – in different media. The second part is an inquiry into the future of humanity as it emerges from a film, Interstellar*, pigeonholed as science fiction but bearer of much scientific evidence and educated guesses about future chances of survival in an environment destroyed by centuries of careless human activity. The film is analyzed using some tools that belong to TRIG (Theory of Inventive Problem Solving).*

Keywords: global warming, hyperobjects, the future of humanity, Interstellar, TRIZ

Introduction

There is a complex and closely interdependent relationship between man as a social and cultural being and his natural environment. Nevertheless, at the beginning of the 19th century, the human and the natural came to be separated as different sciences within which man subordinated nature to his own purposes. Since then, any human endeavour has apparently become exploitative of nature. Developments in science and technology triggered over two hundred years of dynamic intervention in the environment. Hawking considered that man created computer viruses as a new form of life and stated that "maybe it says something about human nature, that the only form of life we have created so far is purely destructive. Talk about creating life in our own image" (Ferguson, 2011: 179).

Ecology and the way of the world

The second half of the 20th century witnessed a growing recognition of the damage caused by the most trivial aspects of human interference as well as an awareness of the possible consequences and, correspondingly, a change in attitude could be discerned. Already in 1967, speaking about the ecological crisis, White was asking: "What shall we do? No one yet knows. Unless we think about fundamentals, our specific measures may produce new backlashes more serious than those they are designed to remedy" (1204). It took another twenty years for the field of environmental studies to make the subject of projects and conferences and to include literature courses in its curriculum. From Thoreau's *Walden* (1854) to Lopez's *Arctic Dreams* (1986) and further on in the 21st century, books celebrating the physical and spiritual re-discovery of nature, life in elemental surroundings, and man's communion with the landscape were re-evaluated in their environmental dimension. Ecocriticism was born and together with it new ecological perspectives. "Nature, mostly through landscape, came to play the role of character in literature and, since all literature exists in space, it also exhibits the strong connection between the author, the work and the place they all belong to" (Coșer, 2014: 124). Celebration of the natural environment became blended with an openly declared concern with its devastation, mostly (but not only) due to climate changes induced by human carelessness and irresponsibility, and found expression in fictional and non-fictional literature, as well as hundreds of documentaries and films. Bill

Bryson, who has an impressively wide audience on several continents, is one of the contemporary authors who expresses serious concern for the changes already visible in his immediate environment and draws attention to irresponsible energy wastes (1998(1)), as well as to the disappearance of natural sceneries under the circumstances of global warming, as he could notice them while trailing the Appalachians (1998(2)). Leonardo DiCaprio is trying to raise awareness to the way people endanger the planet and their future together with it in a much more straightforward way. Designed as UN Messenger of Peace, he travelled around the world for two years, coming into touch with all the people who could make a difference or simply present the scary facts. He talked to presidents, state-secretaries, scientists and countless environmentalists to disclose facts that seem fantasy today but may be the reality of tomorrow. One cannot claim living in the vacuum anymore; the cruel truth is that global warming and the disorders climate changes are causing to the environment may overthrow the already much challenged balance of the planet.

In 2006, Hawking launched a question on the internet: "In a world that is in chaos politically, socially and environmentally, how can the human race sustain another 100 years?" He later resumed: "I don't know the answer. That is why I asked the question, to get people to think about it, and to be aware of the dangers we now face."

Timothy Morton is one author who went deep into "thinking about it." His brilliant non-fictional book *Hyperobjects* (2013)[1] is an object-oriented ontology and a complex cognitive mapping of the present and the future, a wonderful exploration of the dangers of global warming. Starting from the hypothesis that "the end of the world has already occurred" in 1784 when James Watt's steam engine started covering up the Earth's crust with carbon, the book shifts our worry about the end of the world towards a situation in which this "might already have taken place" (16). Thus Morton, walking the reader through his remarkable knowledge of philosophy, religion, literature, the arts, quantum theory, basing his study on Kant, Heidegger, Newton, Wordsworth, Sartre, Einstein, Niels Bohr, and referring to *Twin Peaks,Star Wars,* the Buddhist thangkas, Pink Floyd, paintings, songs and cartoons (the list is endless in all domains), builds the substance of this book melting everything together in one labyrinthine vision which often leaves the reader baffled while the author connects subatomic levels with cosmological dimensions. The purpose is to awaken us from inhibition and prompt us to take action against global warming.

The 'hyperobjects' of Morton's description are objects we live with and are surrounded by. They are "harbingers of a truly postmodern age" (12), already here in our "social and experiential space" (27). They are not mental constructs, but real enormous entities withdrawing their primordial reality from humans and being so vast in their spatial and temporal dimension that they urge us to reconsider our ideas about what things are. The Earth, its biosphere, its climate, global warming, nuclear materials, plutonium, or the five-thousand-year-old Florida Everglades are only a few examples of hyperobjects They impact on the way we reflect on our place on Earth and in the cosmos and seem to force on us "something that affects some core ideas of what it means to exist, what Earth is what society is" (15).

Morton enumerates the features of hyperobjects. The first is *viscosity,* which is "a feature of the way in which time emanates from objects, rather than being a continuum in which they float" (33). People, countries and continents are caught in the vastness of the hyperobject. From the viscous surfaces of the hyperobjects Earth and biosphere nothing can be peeled. Such a large hyperobject as the entropy of the universe causes all beings to be

[1] Subsequent quotes will refer to this book, unless otherwise mentioned.

trapped in some form of death. The second feature is hyperobjects' *nonlocality,* a technical term borrowed from quantum theory. Neither global warming nor nuclear radiation can be seen as such but one is aware of the burning of the sun, or of nuclear accidents. They are invisible and impossible to locate, nevertheless they have long-term consequences. The experience of the weather, of raindrops falling here and now is only a false immediacy: it's always a manifestation of global warming. Reality is nonlocal unless the speed of light can be violated, which constitutes the paradox concerning quantum theory, Zeilinger having demonstrated nonlocal phenomena using entangled particles in different parts of the world. An electron is real, but it may change into other particles or radiate energy and in this act of change, it is a statistical performance, having no intrinsic properties at all. All objects should be seen as enclosing "incompletely defined potentialities" (44) that appear only in case the object comes to interact with a certain system. A third feature identified by Morton is *temporal undulation*. Quoting Minkowski's geometrical proof of relativity and relying on the impossibility of breaking the speed of light, one can consider all events taking place within a light cone, therefore, other events counting as past and future are easy to specify. But 'now and then,' 'here and there' become meaningless outside the lightcone; therefore, for events outside the cone, there is no certain place or time and it is impossible to say whether they happened in the past or will happen in the future. "Time as such, construed as a series of points that extends like Cartesian substances 'into' the future 'from' the past is itself an aesthetic phenomenon, not a deep fact that underlies things" (67). The plastic bag telling its maker that it wishes it had been created mortal gives a real sense which makes it easier to assume "forever" rather than "very large finitude" (60). Tom Gauld's cartoon, *Two Rocks Converse*, comically shows the way in which universal temporality intersects with human temporality and agency: geological changes happen at very large temporal scales. *Phasing* as a fourth feature further explains hyperobjects' nonlocality: they cannot be seen in their totality, only pieces at a time. They are phased, being placed in a "high-dimensional *phase space* that makes them impossible to see" (70) except for slices of them at any moment in time, which is why global warming cannot be seen. What we see of it are "snapshots of what is actually a very complex plot of a super complex set of algorithms executing themselves in a high-dimensional phase space" (70). The same way, recurrence of such celestial events as a comet or an eclipse is part of a continuum that shows up only for a while in our cognitive and social space. The relationship between the moon and the Earth is responsible for our perception of waxing and waning moon and not the moon itself. *Interobjectivity*, the last feature, forwards the hypothesis that our minds are influenced by hyperobjects since the latter "are by definition the largest, longest-lasting objects we know; and since they strafe and penetrate the physical body at every available opportunity" (85). The space provided by this feature is ontologically "in front of" objects, which allows phenomena such as the *mind* to happen.

In Morton's view, the *world* itself, as the background on which events happen, is "an objectification of a hyperobject" (100), since evolution, capitalism, even economic relations compose hyperobjects. Hyperobjects allow us to discover ourselves on the interior of some objects, bigger than us. *Eco* in ecology means *oikos*, that is home. At the level of the planet, it means finding oneself in "a series of 'objects wrapped in objects': Earth, biosphere, climate, global warming" (119). Responding in an ecological way means accepting both the radical uniqueness and the withdrawal of things.

The problem with global warming is that it is not only locally significant but it covers the entire surface of the Earth and 75 percent of it stretches into the future. Another problem is that, by the time we notice it, it's already here. The end of the world, Morton asserts is the

beginning of history; reality, as humans come to acknowledge, is not significant only for them, but they are now in a position to build new alliances with non-humans.

> The hyperobject is indeed the bringer of fate, destiny, death. This destiny comes from beyond the (human) world, and pronounces or decrees the end of the world. This decree marks a decisive pivot in Earth history in which humans discern the nonhuman and thus reckon the fate of Earth with greater justice (148).

Morton introduces two more presumptions. We live in an era of hypocrisy and asymmetry. The time of the hyperobjects is one of "*hypocrisy, weakness* and *lameness*" (148), the worst instance of hypocrisy being cynicism. Finding a valid reason for dealing with the problem of global warming may be the factor inhibiting the very action. Labelled as "a wicked problem," or nowadays a "super wicked problem," global warming is a problem that can be easily understood but no one can provide a rational solution for lack of a central authority, for policies backing in front of apparent irrationality, and because the ones trying to find a solution are also creating the problem. Nevertheless, time is running out.

The postromantic and post-modern phases are called the Age of Asymmetry and Morton traces their histories. What happens in the epoch of the Anthropocene is that humans have come to the gradual realization that at this moment when they master the most glorious technical breakthroughs at planetary scale, they are not actually "running the show" and are not "the conductors of meaning" (164). The "goose bumps" that accompany primordial experience are the same when encountering the aesthetic experience of the hyperobject, "detected as a ghostly spectrality that comes in and out of phase with normalized human spacetime" (169).

Hyperobjects, being toxic, intimately connect us to our own death but also to others, everybody being affected; and also to the future due to their extensive distribution in time. Attuning to this intimacy is difficult. "Yet intimacy and the no-self view come together in ecological awareness. The proximity of an alien presence that is also our innermost essence is very much its structure of feeling" (139).

Morton's technical penchant goes side by side with his affinity for romantic associations all through the book. Human egos can be expected to be marked with the traces of hyperobjects. "We are all burned by ultraviolet rays. We all contain water in about the same ratio as Earth does, and salt water in the same ratio that the oceans do. We are poems about the hyperobject Earth" (51). The question is how long it takes us to acknowledge our roles and responsibilities. The road we are travelling right now will end in disaster, the one we will hopefully take will lead to the preservation of life and the planet. Rachel Carson wrote the following line in 1954: "The more clearly we can focus our attention on the wonders and realities of the universe about us, the less taste we shall have for destruction."

Interstellar

In the 60s literature adopted dark post-apocalyptic scenarios involving survivors who were trying to save what was left of mankind's heritage while re-creating the human race. "All those apocalyptic narratives of doom about 'the end of the world' are ... part of the problem, not part of the solution. By postponing doom into some hypothetical future, these narratives inoculate us against the very real object that has intruded into ecological, social, and psychic space" (Morton, 2013: 103-4). The "very real object" Morton refers to here is the hyperobject 'global warming' discussed above. TV channels focusing on science, history, or technology keep broadcasting new and new ways in which the planet Earth can perish. Nowadays scientific research evolves in some very straightforward directions and cryonics is one of them. To a great extent belonging to the field of science fiction when Dick wrote *Ubik* in 1969, today several institutes around the world promise the possibility of resuscitation.

Exploring the stars is another direction, much vaster and more fascinating in its promise of finding ways of travelling through the galaxy in exploration of planets that could sustain life. "With climate change, overdue asteroid strikes, epidemics and population growth, our own planet is increasingly precarious," Hawking says (Holley, 2017). In 2001, in an interview to *The Telegraph,* he asserted that "I don't think the human race will survive the next thousand years, unless we spread into space." Fifteen years later, Hawkins shortened the period: "Humans need to colonize another planet within 100 years or face the threat of extinction" (Kharpal, 2016).

This is the main theme that the film *Interstellar* (2014) deliberates on. In the middle of the 21st century, dust storms endanger everyday life causing lung diseases while blights destroy staple foods (grains and corn) to the extent that there is an obvious threat of death by hunger menacing the whole population. Secretly the NASA is conducting research for ways of travelling through a wormhole, which appeared near Saturn, and colonize any of the twelve potentially habitable planets in a distant galaxy, near a black hole called Gargantua. Joseph Cooper, a former NASA pilot, is recruited to lead the team that will cross the universe on board the spaceship *Endurance*.

The scientific questions the film raises are extremely complex; therefore, scientist Kip Thorne wrote a book explaining these, as well as the end of the film, which is "grounded from the outset in real science" (2014:11)[2]. The team he worked with set two guidelines from the very beginning:

> 1. Nothing in the film will violate firmly established laws of physics, or our firmly established knowledge of the universe.
> 2. Speculations (often wild) about ill-understood physical laws and the universe will spring from real science, from ideas that at least some "respectable" scientists regard as possible (12).

The use of some tools and instruments of TRIZ (Theory of Inventive Problem Solving) can put the film into better perspective. Altshuller, the inventor of TRIZ, considered that science fiction literature was an inexhaustible source of fantastic ideas, which engineers could then apply to solve technical problems. He created several tools for classifying and evaluating science fiction books and the fantastic ideas that they contain.[3]

One such tool is *Scale "Fantasy-2"* which uses four levels – 1 to 4 (bad, satisfactory, good, excellent) – and five parameters for evaluation. The parameters are the following:

- novelty – meaning difference from the prototype. In this case the subject of space travel as well as of colonizing other planets, the Earth having become for some reason uninhabitable, have been used in many films and books, perhaps with different outcomes. Therefore for this parameter, *Interstellar* would mark low – 2.

- persuasiveness – how convincing a fantastic idea is. The subjectivity of this evaluation is avoided by connecting it with the level of novelty. Thus the mark will be 2 in this case, again.

- human value – the extent to which the idea throws a new or deeper light upon humanity, or opens new ways of investigating man and society. The ideas in *Interstellar* reach out in a sphere where humanity as a whole is connected and the conditions for prophetic vision are fulfilled. The mark is 5.

- artistic value – refers to the perfection of the composition from the point of view of the style and the language in which the idea is presented. In this case, the way the film

[2] Subsequent quotes will refer to this book, unless otherwise mentioned.
[3] All the methods and tools mentioned below and many others are explained at large in Altshuller, 1984, 2000 and Coșer, 2011.

unfolds, the wholeness of the composition which leads to the inevitable and absolute outcome surely deserve a mark 4.

- subjective evaluation – is a parameter that does not have to be backed up with proofs, it is very much a question of personal taste, social, educational, and literary background. Nevertheless, in the course of practice, it acquires an objective value in itself. I would certainly mark it with a 5.

As can be seen the film doesn't mark high for all the parameters. So what makes it special?

For a better explanation of the scientific part of the film, Thorne labelled the status of science in it as "truth, educated guess, or speculation." The particular complexity of the scientific theories that the film relies on reach to Newtonian, relativistic, quantum theory, and quantum gravity. "Correspondingly, some of the science is known to be true, some is an educated guess, and some is speculation," Thorne says (2014: 39). He adds that the status of scientific ideas can change, for example, "For Cooper, the bulk is an educated guess that becomes a truth when he goes there in the tesseract; and the laws of quantum gravity are a speculation until TARS extracts them from inside a black hole so for Cooper and Murph they become truth" (43).

In what follows several of Altshuller's tools will be used to deal with the ideas labelled "speculation" since the real science of the film is explained in Thorne's book.

The situation at the beginning, involving Joseph Cooper and his family, largely relies on the blight that wipes out the edible crops, one by one. Professor Brand's foresight is gloomy: "Earth's atmosphere is 80 percent nitrogen. We don't even breathe nitrogen. Blight does. And as it thrives, our air gets less and less oxygen. The last people to starve will be the first to suffocate. And your daughter's generation will be the last to survive on Earth" (128). Why this prediction is "conceivable," but is nevertheless "highly improbable" is scientifically explained by Thorne (129). What is of interest is the way this science fiction idea could be created. In *Principles of Fantastic Ideas Generation,* Altshuller explains that every new and fantastic idea that is generated gives rise to the development of a new system, which further generates new ideas. The blight can be assigned to the Principle *Increase/Decrease:* starting from a situation that could be the result of negative ecological developments, the size of the problem is increased until "there is 1000 times more undecayed ocean-bottom organic material than geophysicists think" and "a sufficiently vigorous oceanic overturn" occurs (130).

Before the *Endurance*¸ three other volunteers, Miller, Edmunds and Mann, travelled through the wormhole to investigate whether the circumstances on three of the twelve planets could support life. A "non-negotiable" condition for Miller's planet was that one hour on it be seven years on Earth, apparently an impossible demand. But Thorne found a way by using Einstein's relativistic equations: it was possible "if Miller's planet is about as near Gargantua as it can get without falling in, and if Gargantua is spinning fast enough... But Gargantua has to spin *awfully fast"* (72). Gargantua's spin can be traced back to several tools. First of all, to Altshuller's *Size, Time, Cost Operator*, a tool devised to see if a technical problem can be solved if its different parameters, in turn, are changed from symbolic values 0 to infinite. Conventional images of objects are changed through mental experiments and exercises of the imagination. In this case Gargantua's speed was increased to "almost as fast as the maximum" (73) so that TARS' (the intelligent, multifunctional robot) orbital period after falling into Gargantua seemed of about one hour when seen from far away. Salamatov also devised a list of principles starting from parameter *modificatio*n. One of them is "modification of the 'time' or 'speed' parameters" by acceleration or deceleration, which precisely describes the situation on

Miller's planet. Last but not least, the above mentioned *Increase/Decrease* as well as *Acceleration/Retarding* from Altshuller's *Principles* can be applied, both used for changing existing properties of objects and thus triggering new qualities. Playing around with increasing/accelerating the speed of Gargantua and the time element creates the context in which, when the crew returns to the *Endurance* after escaping a gigantic tidal wave, 23 years have passed on the ship.

The wormhole, which appeared 48 years earlier near Saturn and facilitated access to a distant galaxy where potentially habitable planets needed investigation, is classified as "a highly educated speculation" by Thorne while Cooper says it "isn't a naturally occurring phenomenon" (146). If wormholes existed, this could only happen at microscopic scales, in the form of a tiny "quantum foam" which would be a fluctuating network of wormholes "continually in and out of existence in a manner governed by the ill-understood laws of quantum gravity" (146). The Principle *Making Artificial* can be used since, not being natural, the wormhole was probably built and conveniently placed in a position where previously there was none, but which is suitable for easing long-distance travel through space.

From a scientific point of view, "traversable wormholes" could be made only by an "ultra-advanced civilization," facing huge obstacles such as extracting it from "the quantum foam (if the foam exists), enlarge it to human size or larger, and thread it with exotic matter to hold it open" (147). Thus, originally, the wormhole appears to be created by another civilization set to help humankind, an idea already used by Lem and Clarke. The "beings" who created the wormhole belong to a civilization which lives in the bulk and has four space dimensions just like the bulk. "This is terra *extremely* incognita," Thorne says (149). The idea of the bulk is not really a science-fictional one. Brilliant scientists are trying to figure out how matter, fields and forces work if our universe is really a "brane in a higher dimensional-bulk" (211). Their conclusions solidly point towards an attractive and thought-provoking idea: all of the particles, forces and fields we humans know are confined to our brane, except "gravity and the warping of spacetime associated with gravity" (211). This is the scientific core of the film: Professor Brand and later on Murphy are conducting research on gravitational forces, triggered by the baffling gravitational anomalies noticeable on Earth. Other types of matter, fields and forces may exist, but our science, at this point is ignorant of those. The bulk and the bulk beings can be easily explained using one of Altshuller's instruments. Altshuller was not afraid to travel unattended roads to teach engineers to solve technical problems and produce inventions on a regular basis. Thus he was aware of the importance of empathy in solving engineering problems. If a person identifies with a machine, or parts of it, he can imagine improvements brought to it. The problem was that humans were reluctant to imagine actions that harmed them, therefore, Altshuller invented the *Agents* or *Smart Little People* to perform actions where humans failed; they "have eyes, hands, a brain, are capable of understanding and performing actions and select those alterations which the human organism would normally reject" (Coşer, 2011: 84). Thus Agents could have created the wormhole and keep it open for humans to pass.

Imagination would assign the four-dimensional world in which the four-dimensional beings live to one of the principles Altshuller uses in his *Contradiction Matrix: Principle 17 – Shift to a new dimension.* Altshuller noticed that all technical problems can be solved if the contradiction at their core is solved. His *Matrix* contains *40 Inventive Principles* that can be applied together or separately to solve inventive problems. In *Interstellar* the shift is from our three-dimensional world to a four-dimensional one, in which the bulk beings live.

The bulk fields hold the wormhole open as long as needed for Cooper and his crew to pass. Moreover Professor Brand believes, they also protect our universe from being destroyed

and, more importantly, are responsible for the gravitational anomalies on Earth, noticed by Cooper and his daughter Murphy. This could be assigned to *Principle 6* of the *Matrix*, *Universality – have the object perform multiple functions, thereby eliminating the need for some other object or objects.* On the other hand, the wormhole, seen as a means of transport, belongs to Pattern 5 in Altshuler's eight-pattern model of the *Evolution of Technical Systems: Increasing complexity followed by simplicity through integration.* Instead of sophisticated spaceships and multiple difficulties inherent to space travel, the wormhole solved several problems simply and elegantly: it helped cover huge distances without extra energy consumption and eliminated the necessity of spaceships which would have had to be more performing than the NASA could achieve at that moment.

The tesseract is perhaps the most wonderful invention of creative imagination. Cooper and TARS are ejected from the Ranger just before it splits in two and are transported through the bulk into the tesseract, a four-dimensional object, more precisely in its three-dimensional face since Cooper cannot experience its fourth dimension. Principle 17 can be applied once more – by the shift from the third to the fourth dimension and back, the bulk beings (whose real identity we still don't know) can construct the tesseract for the benefit of humanity; but also Principle 6 – Universality, since the Tesseract performs several functions: it replaces the spaceship, it is a means of transport, but, most significantly, it opens the possibility of messaging home, specifically to Murphy, a scene in which Copper transmits to his daughter the missing elements in the equations connected to quantum gravity theory that she, and Brand before her, have been trying so hard to develop in order to lift humanity off the Earth. This is the climax of the film, the moment when generations connect though space and time.

In the tesseract, Cooper can move forward but also backward relative to the time of our brane, that is in Murph's bedroom time. He can choose which bedroom to visit and he can look into it via light which travels forward in time unidirectionally from Murph to him. At first, he is in the future of his ten-year-old daughter, trying to warn his own self not to start on the space journey. Later on, having recovered quantum data from TARS, data they have been collecting from inside the black hole Gargantua, Cooper struggles to transmit this data to an adult Murph by using the gravitational force, which twitches the second-hand of the watch he left to Murph as a token of his return, into a Morse-encoded pattern. Cooper's past is Murphy's future. He becomes young Murph's mysterious "ghost."

> Light can travel from Murph to Cooper but not from Cooper to Murph. In my scientist's interpretation of Interstellar, the one-way barrier has a simple origin: Cooper, in the tesseract, is always in ten-year-old Murph's future. Light can travel toward the future from Murph to him. It can't travel to the past from him to Murph. However, gravity can surmount that one-way barrier, Cooper discovers. Gravitational signals can go backward in time from Cooper to Murph. We first see this when Cooper desperately pushes books out of Murph's bookcase (301).

A new system of communication is presented here, based on gravitational fields and not on the propagation of light or electromagnetic fields. Altshuller observed that technology follows a life cycle of birth, growth, maturity, decline. In six consecutive stages, a non-existent system replaces an old one. The idea of gravitational fields used as a means of communication corresponds to Pattern 7 in Altshuller's *Patterns ofEvolution of Technical Systems – Transition from macro-systems using fields to achieve better performance or control.*

When the tesseract having concluded its purpose folds, Cooper and TARS are ejected. A spaceship recovers them while drifting in space. Cooper is taken to a NASA facility where he reunites with his ninety-four-year-old daughter who, using the quantum data transmitted to

her by her father while in the tesseract, was able to develop the gravitational propulsion theory. Cooper is shown an enormous cylindrical enclosure that can carry thousands of people into space to form colonies for the coming generations. Other such enclosures are being built. Thus harnessing gravity proved real. By reducing Newton's gravitational constant G for a very short interval, namely one hour, rocket engines were able to lift giant colonies into space. The Earth is damaged in the process: bereft of its surface pressure, its core springing upward, tsunamis and earthquakes follow and the same happens as the Earth shrinks back in an hour's time. But meanwhile the colonies rocket into space and humanity is saved. Murph reminds Cooper that Amelia Brand and CASE are still alone, trying to set up a colony on Edmund's habitable planet and Cooper and TARS "hijack" a spacecraft to join them. The lifting of the colonies based on reducing Newton's G can be traced back to one of the *Principles of Fantastic Ideas Generation: Changing the Unalterable*. This means that absolutely constant properties of phenomena or objects are modified in order to create a new fantastic idea, or to solve a technical problem, which is the case here. Moreover, one of Altshuller's *Separation Principles: Separation in Time* is also relevant: it applies when a requirement exists at one time interval but is absent at another. To apply this principle the following question needs to be asked: "'Do we need the parameter to be 'positive' and 'negative' at all times, or is there some time interval(s) during which it is not necessary?' If such intervals exist, it might be possible to separate the opposite requirements to the key subsystem in time" (Savransky, 2000: 243). For lifting the colonies, the parameter that needs to be "negative" (absent or smaller) is gravitation. But this necessity applies for only a short period (one hour) because the final purpose is not to destroy a planet but to save the people inhabiting it.

A complex analysis dealing with the story line and plot in different systems and timelines, explaining the relationships between the characters and defining the role of the symbolism involved would need the use of several other tools (*SU-Field Analysis, the Multiscreen, the Fantogram, the Four Floor's Scheme*, and quite a few others). But these tools are not needed in order to answer the question asked at the beginning: What makes this film so special? The answer is to be found in one brilliant, unexpected idea, one that gives hope for the future of humankind: Christopher Nolan, co-writer and co-producer of *Interstellar*, ends the film with his own declaration of faith thus giving an overwhelming meaning to the whole: the bulk beings, those who created the wormhole and the tesseract holding out a hand to the dying humanity, are our descendants, who in the future have acquired that additional fourth dimension and live in the bulk. Towards the end of the movie, Cooper says to Tars:

> "Don't you get it yet, TARS? They aren't beings. They're us, trying to help, just like I tried to help Murph." TARS responds, "People didn't build this tesseract." "Not yet," Cooper says, "but one day. Not you and me but people, people who've evolved beyond the four dimensions we know" (213).

What is science fiction today is the technical breakthrough of tomorrow. This has extensively been demonstrated by early sf writers such as Verne and Wells. There are several reasons that give rise to inventions. I will mention only two of them because both apply to the story and the science behind *Interstellar*: a response to a threat and a response to an existing or future need. Last year's Nobel Prize in Physics validates the importance of studies about gravity for the future. It was received by Rainer Weiss, Barry C. Barish and, not surprisingly, Kip Thorne, who on the 14th of September, 2015, captured for the first timegravitational waves whose existence was predicted by Einstein a hundred years ago. They travelled in space for 1.3 billion years before reaching the USA's LIGO detector.

Conclusion

Each day brings new perspectives on the problems of environment, ecology and global warming. New decisions are made and very often, in spite of clear evidence that humans cause the climate change and the dangerous consequences it involves, there are voices at the highest levels questioning the reality of the science of climate change and delaying beneficial environmental projects. Fortunately, there are many more voices warning about the vulnerability of the planet at this point in its evolution. No small-scale action is pointless, presidents and high officials can change opinions under the tenacity of public opinion. And while research about possibilities of leaving the planet will certainly continue, the Earth will still have a chance.

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