

## SCIENCE FICTION AS A FUTURISM TOOL FOR MOON COLONIZATION

“Yes, gentlemen,” continued the orator, “in spite of the opinions of certain narrow-minded people, who would shut up the human race upon this globe, as within some magic circle which it must never outstep, we shall one day travel to the moon, the planets, and the stars, with the same facility, rapidity, and certainty as we now make the voyage from Liverpool to New York! Distance is but a relative expression, and must end by being reduced to zero.”

“From the Earth to the Moon”, Jules Verne, 1865

Jean-Marc Marlier-Costa

Since the beginning of sentient times, humanity has always raised its eyes to look up at the sky to our faithful companion: The Moon. Perhaps that was the thought of Arthur C. Clarke, one of the most Moon inspired authors of Science Fiction when he named his famous ape character in the book *2001: A Space Odyssey*, the “Moonwatcher”. The Moon has long been this impossible dream that aroused the collective imagination for millennia, so close yet so far, so familiar yet so unknown. Before Jules Verne, the literature about the Moon – should we call it proto-Science-Fiction? - was essentially a mean to a higher philosophical reflection and critique about Humanity and society at that time. Actually, that’s still happening today with the modern Science Fiction. The forthcoming colonization of Space also raises ethical key questions about Mankind itself and its capability to spread ethically and peacefully among the stars. As a matter of fact, Science Fiction has always been – it is its principal claim – an inspiration for space colonization, particularly regarding the conquest of the Moon. By the time of the Apollo missions, stories of space travel and travel to the Moon were so present and popular in the collective mind of the public, that the first step on the Moon was not only the triumph of America and its Culture but also the crystallization, for all Mankind, of this ancient and profound wish since we were able to stand on our feet and look at the sky: To go to the Moon!

The aspiration of this presentation is to demonstrate before this audience, among several examples, the relation and mutual influence between Science and Science Fiction regarding Moon colonization. Thereby, establishing that Science Fiction can be a useful tool in terms of a simulation ground in order to anticipate (crucial) steps or difficulties, to approach new themes and to positively influence human settlement on the Moon.

Firstly I will refer to The Ones who, initially and at the risk of their own lives, intellectually and boldly went where no one had gone before and first conceived the Universe, Life in the Universe and the place of Humanity in it, in the respect of the scientific standards of that time against the beliefs imposed by the Church. A time when Science and Fiction started a mutual connection that, we can say with pretty much certainty, is still today as close as the one that links Earth to the Moon, with fiction often crossing the line of imagination to reach real life as we will see further in this presentation. In a time of fundamental developments in astronomy, mathematics and mechanics, speculations about the moon and the fact that perhaps, it could be inhabited were starting to take shape. *The Man on The Moone*, by Francis Godwin (published in 1635) was a significant, although historically forgotten, major work about our satellite. Considered the first Science Fiction book written in English, the influence of the new scientific discoveries are pretty perceptible in it. Godwin's chronicle appeared four years after the astronomer Johannes Kepler's *Somnium sive opus posthumum de astronomia lunaris* and just five months before John Wilkins's *A discovery of a new world*, both of which also raised the question of the inhabitability of the Moon. Few years before, in 1610, Galileo's *Sidereus Nuncius* - itself inspired by Copernicus's *De revolutionibus orbium coelestium* - had ignited the interest of the scientific community regarding our natural satellite. For the first time ever, a telescope was used to observe the sky and Galileo delivered a detailed observation of the Moon with several drawings of his observations as well as descriptions, explanations, and theories. He provided the World with a new shape of the lunar surface and, therefore, a new representation of it.

Godwin's narrative describes the adventures of Domingo Gonsales who accidentally travels to the Moon using a machine pulled by wild geese. He discovers that our satellite is inhabited by giant Christians who live in a Utopian paradise and "doe hate all manner of vice, and doe live in such love, peace, and amitie, as it seemeth to bee another Paradise." Furthermore Godwin's extrapolation, he also stated that the dark areas on the Moon could be seas and through his main character he developed a few controversial theories, among others, the diurnal rotation of Earth or its magnetic attraction.

Translated in several languages the impact of this book was enormous in Europe. It is thought that this book influenced Cyrano De Bergerac's *L'Autre Monde ou Histoire comique des États et Empires de la Lune et du Soleil*, written between 1657 and 1662. Through a utopian tale of an improbable

travel across the Earth, the Moon, and the Sun, the author expresses his materialist philosophy and delivers a social and political critique towards the society of the 17<sup>th</sup> Century and against Human Anthropocentrism. Each voyage is linked to a scientific hypothesis and each world leads to a reflection about the Human Being and his cultural and social limitations. Note that the structure of the novel is very close to the concept of any modern Science Fiction TV show like Star Trek or Stargate for exemple! At the beginning of the narration, the main character declares, looking at the Moon, that this orb (Moon) "is another world like ours that serves theirs as the Moon" (free translation). He, then, decides to go and see for himself by attaching vials of dew to his clothes which, heated by the temperature of the Sun, propels him into the sky (a wink to the myth of Icarus). This first attempt being unsuccessful, he reaches the moon by a machine that he doesn't describe and meets another terrestrial that raised himself up by a Montgolfier mechanism and a toga used like a parachute. During his voyage Cyrano, through his main character, approached the Copernicus system theories, the Galileo thesis and had the intuition of the gravitational law that will be enounced by Isaac Newton nearly forty years later. One of the machines appearing in the story, the flying dragon, evokes to us the modern rockets with their several stages!

Then, in 1686, five years after the passing of the Kirch Comet (C/1680 V1) and nearly 50 years after the Galileo trial, Fontenelle wrote *Conversations on the Plurality of Worlds*, one of the first major works of the French Enlightenment defending heliocentrism and making a thought experiment on the possibility of extra-terrestrial life on other worlds and ... on the Moon. Without saying much about the selenites (inhabitants of our moon), he imagined rough life conditions forcing the inhabitants to live in buried cities and tunnels in order to save themselves from the radiations of the Sun. In this case, fiction is not used to induce the reader in error but to give him the possibility of thinking about this probability. The importance of this work lies in the use of scientific facts supported by fiction to enhance the fictional aspect of the story and contribute to one of the first works of scientific universalisation. The way of life imagined for the selenites implies that it would be the same for humans: life on the Moon in underground structures!

Almost 200 years later in 1865 and 100 years before Apollo 11, at the pinnacle of the Industrial Revolution, Jules Verne sent humanity to the

Moon like no one had imagined before. Industry and Science through technological innovations like (the first steps of) electricity or telephone, hot air balloons and other means of transport and communication shortened distances and contributed to create a renewed and positive vision of the Future. The French writer centred his work on voyages and adventure but always resorting to scientific accuracy especially regarding the amazing machines invented in his stories, opening a new path for Science popularization. Such contributions reduced substantially the relation between reality and fantasy, between Science and Fiction creating the idea not only of possibility but also plausibility of such stories, reminding us of a sub gender of Science Fiction: Hard Science Fiction. In that sense, *From the Earth to the Moon* is an essential turning point with almost every topic regarding the conquest of the Moon as it would occur a century later. Besides anticipating the telescope of Mont Palomar (conceived in 1928 and constructed in 1948), Jules Verne also anticipated the take-off of rockets from Florida and the landing at sea of the space capsules that became so familiar to the world since the Apollo Missions. Also, to a certain point, through his wagon-train concept to the Moon, he got ahead with the notion of multistage rockets. In the same book, he would first evoke the concept of solar sail, propelling the "Columbiad" to the Moon, an idea that would become reality nearly 145 years later in 2010 with the IKAROS project from the JAXA and, more recently, with the LightSail project of the Planetary Society. Even the improbable Jules Verne space cannon concept would be studied by the U.S. Army's Ballistic Research Laboratory in the early sixties of the XX<sup>th</sup> century through Project HARP - High Altitude Research Project. From 1983 to 1992, the Lawrence Livermore National Laboratory from California (USA) worked on the same technique through project SHARP - Super High Altitude Research Project. He would also, although briefly, approach the political concern of Moon colonization. At the time Jules Verne wrote his novel, the United States had just achieved their union after American Civil War. The character of Impey Barbicane, president of the Gun Club of Baltimore in the novel, establishes the reference to Cristopher Columbus regarding the conquest of the Moon, designating it as a national ambition. It is curious to note that the same national enthusiasm would be the guideline of John Fitzgerald Kennedy's famous speech "We choose to go to the Moon", officially titled *the Address at Rice University on the Nation's Space Effort* on September 12, 1962 at Rice University (Houston, Texas)! The Industrial Capitalism investment in space is another foresight

from Jules Verne: It is the Baltimore Gun Club, a private association of gun enthusiasts that built the project. Today, the new space companies such as Space X or Blue Origin are growing in prominence regarding the space race and ... the return of humans to the Moon! I would also point a significant and symbolic detail on Jules Verne's story: as noted earlier, the novel takes place shortly after the American Civil War and it is a military device – a cannon – that is used for scientific and peaceful purposes that provide the protagonists of this adventure the voyage to the Moon. Finally, a curiosity: Konstantin Tsiolkovski, the Russian astronautic pioneer, was a confessed reader of Jules Verne's novels and admitted that he had been influenced by them.

When the cinema industry first appeared, due to the fascination exerted on Humanity, the Moon was naturally one of the first characters appearing on the white screens, and the first character of the first Science Fiction movie ever, I am referring to the Méliès *Le Voyage dans la Lune* (1902). But it is the cinematic work of Fritz Lang *Frau Im Mond* (1927), based on a story written by his wife Théa Von Harbou, that is particularly interesting and significant for Science Fiction and Moon exploration. First, like the title indicates, for the German director and his wife, space exploration should not only be intended for man but also open to women, which represented a major social statement at the time the movie was made. Then, as Fritz Lang was a perfectionist, he asked the technical guidance of Hermann Oberth responsible for the German *V Rocket* Project during World War II and one of the founding fathers of rocketry and astronautics. As a matter of fact, *Frau Im Mond* brought not only cultural legacy but also a legacy among many rocket scientists, one of them, a former student of Oberth, Wernher Von Braun. Contributing to the legend around this cult movie, some of the operational features of the film became, afterwards, part of any rocket launch procedure until today: the facility where the movie rocket is built is situated near the launch pad, the existence of the launch pad, the launching countdown made from 10 to zero, the pool of water at the base of the launch pad is still used today to dissipate the extreme heat and to damp the noise generated by the rocket exhaustion, the multi stage rocket which has been adopted until today, the beds of the rocket in the movie to deal with the G forces during elevation is comparable to the adapted seats in use today for the same reason and the straps to counterpart the effects of zero gravity as we can see today, for example, in the International Space Station! *Frau Im Mond* also exerted an influence on a Belgian cartoonist in the artistic field of the European "Bande Dessinée":

Hérgé, who also asked for Hermann Oberth's expertise for his third album to send his hero, Tintin ... to the Moon! This work would take him nearly four years and a nervous breakdown (he was forced to stop his project for almost a year). The first scenario was written in 1947. Rocket science was in an early stage and the unique existing reference was the German V2 rocket missile (the first photograph of Earth ever taken from space was from a V2 rocket the 24<sup>th</sup> of October 1946). Hérgé made an exhaustive research in the scientific press of that time and consulted many astronautic specialists like Oberth or Bernard Heuvelmans (*L'Homme parmi les étoiles*). He was acquainted to the outstanding physicist Auguste Picard (*Entre Ciel et Terre* – 1946) who inspired him his famous character of Professor Calculus. It is from those two albums – Destination Moon (1953) and Explorers on the Moon (1954) – that Calculus started to use an ear horn just as the astronautic scientist Konstantin Tsiolkovski! The first drawings were launched in *Tintin* magazine on 30 March 1950. But in the same year, a French scientist, Alexandre Ananoff published the book *L'Astronautique* that would impose a delay in Hérgé's work, who immediately contacted Ananoff to ask for his advice as we can understand in the letter he wrote him "I am currently preparing a story of anticipation entitled *Explorers on the Moon*. I wish to treat this subject with the maximum of plausibility, and I would like that my characters, in their voyage to the moon, would use a spaceship as real as possible" (free translation). The result of this hard work is an incredible visual adventure through which the public (young and old) would learn in a fun way about X-rays, gravity, zero gravity environment and artificial gravity, space suits, ergonomics for space, rocket science and nuclear engine as well as lunar geology!

Almost 11 years before Yuri Gagarine's first space flight and 19 years before Apollo 11, Hérgé sent Tintin to the Moon in a V2 Nazi type rocket (the Apollo Missions were sent by the Saturn V rocket developed by Wernher Von Braun the scientist behind the Nazi V2 missile program!), a reusable spacecraft like the Space X rockets today, with a plausible Moon landing site and a correct approach of the 0 gravity environment and the presence of water on our satellite! Regarding Space X, the resemblance between Hérgé's rocket and the Spaceship is impossible to ignore and was confirmed by Space X CEO, Elon Musk when questioned about the StarShip project: "I love the Tintin rocket design, so I kind of wanted to bias it towards that". As noted in the case of the Jules Verne novel, Hérgé did not make a trivial option by powering his rocket with a nuclear reactor. Five years after the end of WWII, it is rather a significant and symbolic choice that a technique used to create

a weapon of mass destruction is used for scientific and exploration purposes. Besides that, since the beginning of the XX<sup>th</sup> century, scientists had already started to think about this issue. The RTG - Radioisotope Thermoelectric Generator technology was invented specifically for space exploration in 1954 and first applied in 1961 in a US military satellite with 96 grams of Plutonium 238. The project code-named Taylor. Technically, it consisted in ejecting and exploding atomic bombs behind the rocket some distance away. Propellant (water or wax) surrounding the bombs would be transformed into high-energy plasma and bounce off a pusher plate at the rear of the rocket and push it forward. Shock absorbers would even out the ride. The project was cancelled due to the 1963 Nuclear Test Ban Treaty. In 1955 project NERVA - Nuclear Engine for Rocket Vehicle Application – was developed and, after the creation of NASA, three years later, it was associated to it to provide a viable propulsion for application to the NASA Space Exploration Initiative (SEI). At the time of the Apollo project, the NERVA engine had already been ground tested and was to be applied to the Apollo program and then, to be extended to the exploration of planet Mars. In 1972, with the end of the Apollo program, the American Congress shut down the NERVA project. Currently, ORION featured an extraordinary propulsion method known as Nuclear Pulse Propulsion. The ORION program was developed in the 40's, 50's and 60's by General Atomics that gather a team of some of the best physicists in the world (one of them the well-known Freeman Dyson), led by Professor Ted NASA is leading an effort, working with the Department of Energy (DOE), to advance space nuclear technologies. In July this year the government team has selected three reactor design concept proposals for a nuclear thermal propulsion system which would use high-assay low-enriched uranium fuel.

Based on Arthur C. Clarke's short stories *The Sentinel* and *The Children of Icarus*, *2001: A Space Odyssey* is a novel and a film written and developed by both the author and the director, Stanley Kubrick. They worked almost five years on this project and on research, with NASA and other members of the space and computer sectors, to make the film as realistic as possible. And the result is astonishing: amazing images of the Earth and the Moon that did not exist yet, since the movie was released in April 1968, several months before the Apollo 8 and especially Apollo 11 missions, were presented to the world. Besides that, the movie portrayed with great accuracy interplanetary travel, credible protocols, the correct use of

centrifugal force to recreate artificial gravity in the spaceship, the absence of sound in space, the slowness of manoeuvres, the technological tools of the astronauts and the forthcoming of the Artificial Intelligence. All contributed to an unmatched Science Fiction masterpiece acclaimed by the critic and scientific community that also gathered an homage from NASA which named the spaceship of the Apollo 13 mission *Odyssey* after the main title of the movie!

In this story, although the Moon does not play a central role it fulfils a crucial and initiatory part: it is on lunar ground - the *Tycho* crater - that Clarke and Kubrick rest the mysterious black monolith, establishing a symbolic parallel with the emancipation of Humanity in Space consisting in implicitly admitting that our natural satellite is the first obligatory and logical step for humanity to discover the Solar System and to spread among the stars. One year after the release of *2001: a Space Odyssey*, Neil Armstrong was stepping on the Moon (and pronouncing) “One small step for Man, one giant leap for Mankind”, confirming the symbolic statement of *2001: A Space Odyssey*. That moment in Humanity’s history is one of the most significant: for the first time Science Fiction transcended reality to a point that reality is still struggling today for its existence against the complot theory defending that the same Stanley Kubrick is responsible for the filming of NASA’s alleged hoax.

In the novel, as well as in the movie, Dr. Heywood Floyd goes to the Moon to observe a monolith, estimated to be millions of years old that emits a powerful radio signal towards Saturn. We follow the professor in his trip between Earth and the Moon, via a huge space station and to Moon base *Clavius* where a scientific and technical community of 1000 men and 600 women is working. Again, Arthur C. Clarke’s vision is still accurate today as the space station of the fiction reminds us of the very real and actual Gateway of the Artemis program that will be essential for Human return to the Moon and the anticipation of a permanent inhabitability of our natural satellite.

It is, however, interesting to read the text, probably written by Kubrick himself, included in the press kit given to journalists for the screening presentation of the film in 1968:

“Less than an hour ago, you were rocket-launched from the Kennedy Spaceport in New York City on a journey that will take you to the far reaches of the universe. Your first stop is the slowly spinning wheel of Space Station



5, which orbits far above the equator. You disembark in the space city three kilometres in diameter to reach the shuttle to the moon. As you wait in the spacious Observation Hall, you have a breath-taking view of Earth. The dazzling spectacle passes before you at the rate of twice a minute, as the revolution of the space station is that of a cosmic carousel. During its rotation, the centrifugal force gives you a feeling of normal gravity: you can walk on the curved floor, pour yourself a drink knowing that the liquid will remain in the glass, you can distinguish between "Up" and "Down".

In exactly two days, you will land on the Moon, this once inaccessible world, to face a mystery that has arisen from the past, and which now baffles the most discerning minds of the twenty-first century. Your shuttle takes you across the abyss of more than four hundred thousand kilometres that was crossed for the first time by the astronauts of the seventies. In the *Clavius* crater, more than two hundred and forty kilometres wide, you are greeted by scientists from the recently built space research station. It is a small underground city which is almost entirely self-sufficient, so much so that it no longer needs to be supplied by Mother Earth. Children have already been born there who do not know other countries; *Clavius* base is the first human colony in another world. Here, scholars uncover the secrets of the Moon and learn of ways to survive on even more hostile planets. Hours later, you sail far above the Lunar Plains, en route to a distant science outpost in the giant *Tycho* Crater. And there, in this lonely camp in the middle of the lunar desert, you find yourself in front of a mystery which will shake the world; there you find the first sign that Man is not alone. You are now further from home than any man has ever been" (free translation).

*2001: A Space Odyssey*, illustrates and celebrates the technological achievements of Humanity and the sacrifices made in order to reach this achievement but it initiates a new vision of space exploration as the Moon is no longer that strange world imagined 500 years ago. That is what *Moon* (2009), from Duncan Jones, is all about. In this movie, the director addresses key ideas for Moon colonization such as Moon settlement, human identity and psychological resilience, Moon mining, private investment in space exploration and the importance of Law and its regulation. The plot is rather conventional, centred on a worker in a helium 3 lunar extraction industrial unit (Earth based company), with only a robot for companion (a reference to HAL from *2001: A Space Odyssey*). On the eve of his scheduled return to his family on Earth, after three years spent working on the Moon, he is suddenly plagued by hallucinations after having an accident outside the

base. What Duncan Jones proposes to us is a plausible scenario describing the daily work in an industrial facility on the Moon. Almost all the systems of the compound are automatized but still requiring, however, an essential human presence for the maintenance and management of the facility as well as the harvest of the Helium 3 from the extraction platforms and to forward it properly to Earth. In the movie, the average energy covering needs for this resource is estimated to be around 70% of the planet's global energy needs. In this vision, Moon exploration will be held, by the necessity of energy alternatives for Earth, by private economical corporations, which inevitably raises the questions of the attribution of the Moon working market: what organisation will regulate this market under what kind of law and what kind of law enforcement authority? Elon Musk and Jeff Bezos have already spoken of Moon – and even Mars – settlements and the transfer of polluting industries from Earth to the Moon implying that those settlements would be “private ground”. I think that what Duncan Jones points out in this movie is the fact that for any corporation, costs and profits in such investment are much willing to lead to the temptation of company abuses of all kind. For instance, in the movie, the company uses, disregarding all ethics, the Human cloning bio engineering technique to solve their “human factor” problem on the Moon. We can easily extrapolate that the way humanity is going to plan Moon colonization and make it, will be the role model for, at least, the exploration of the solar system. Will Moon colonization be a new *Wild West* or are we going to take the right measures in order to develop a suitable Moon exploration and colonization? The other and central theme of the movie is human identity and human resilience in the space context. We can without difficulty infer that working and operating in space will be a trial and will put human resilience at test, especially at the beginning of Moon colonization. We can, also, deduce that only a few adventurers will dare to embrace those new careers. In the Movie, Sam Rockwell's character life is boring and so lonely that we can't imagine that he is there for three years: he does sports activities to keep in shape, makes models, waters a plant for fun or watches videos of his family. GERTY, the A.I., a sort of Google Home assistant in the base, is his only social and also professional companion. Like in *2001: A Space Odyssey*, the movie brings the question of the role that we are going to allow A.I. to play in Moon colonization. Will it be a strong and autonomous A.I. in charge of most of the Moon facilities? Will it be a soft A.I. like GERTY only intended to help in the management of Moon facilities

and entertain the Moon working force? Will it take a human shape with androids in order to fool our need for socializing? These are a few but relevant issues that need to be properly debated and studied as they represent crucial steps that will have an impact also on our life on Earth.

The Moon has long been this unreachable goal yet a constant motivation in Human history. With the help of the emerging Science of the Enlightenment Century, imagination first pushed the limits stimulating the reflection of life on Earth and beyond. From Utopias, plays, anticipatory novels to Comics, Cinema and Television, it is the fidelity to Science in Science Fiction that created bridges between fiction and reality arousing the will to conquer the Moon. That is that same and strong determination that stands out in John F. Kennedy's speech at Rice University in 1961 and made possible the Apollo missions. Science Fiction is a kind of fiction generating knowledge when combined with Science as explained in the examples of this presentation. It is Hard Science Fiction, in which scientific accuracy is a central point in the story, that contributed to celebrate authors like Jules Verne, Arthur C. Clarke or Isaac Asimov as visionary, idealising and shaping our future providing relevant clues and reflections for Moon colonization. It is my conviction that Science Fiction is a cultural and polymorph mean that can provide an ideal, unsuspected and ideologically free ground to develop ideas, universal themes, unveil solutions and a wide and rich gathering of plausible simulation scenarios for moon exploration.

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