When science fiction turns to reality: Square Kilometre Array (SKA), the largest radio telescope ever imagined

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Abstract

The world's scientific community is building the largest radio telescope ever imagined, with a total collection area of one square kilometre, i.e. a million square meters. This represents a huge technological advance, massive investment, and even greater opportunities. The radio astronomers will be able to monitor the sky with unprecedented detail, sensitivity and speed, aiming to answer several fundamental questions, and creating a wide range of new technological solutions. The magnitude of this project also implies an immensely challenging task: establishing the bridges between society, political and scientific communities. SKA outreach requires the creation of innovative dissemination materials that portrait the instrument from very different perspectives, highlighting its importance to the multiple targets that its technologies address spills to. In this work we explore how concepts are exploited, creating an inspiring sci-fi vision, mostly resorting of video and 3D animations.

Keywords: Radio astronomy, Science communication, Science fiction, Video, 3D animation

Introduction

The unlimited imagination of screenwriters since the beginnings of Cinema provided us with a wealth of imaginative content about the exploration of the Universe through visionary science and technology, introducing for example futuristic tools or skills for space and time travel, picturing the discovery of parallel universes or even representing extraterrestrial life, in ways that became a strong part of the contemporary popular culture. The cutting-edge science and the cinema science-fiction (sci-fi) have mutual influence, the first one can drive cinematographic tendencies, and the second one can easily enhance the impact of recent scientific endeavours. Nevertheless, what was considered by some to be science fiction until now, can turn to reality in the near future with the onset of the construction of the largest radio telescope ever imagined, a 21st century project that will conduct transformational science to improve our understanding of the Universe and the laws of Nature, monitoring the sky in unprecedented detail and mapping it like a giant radio camera, hundreds of times faster than any other current facility. This project will have a positive impact in society that can easily become a motivational theme to be explored since it embraces the dual relation between astronomy and art, and thus can become highly disseminated to the general public.

The emergence of science fiction as a genre

Astronomy and Space sciences are an exciting theme, explored in almost every form of art. It is believed that in cinema, it started during the silent film era, with the black and white short film *Le Voyage dans la Lune*, directed by Georges Méliès, 1902, that was revived recently by Scorsese's film Hugo, 2011.

Fig. 1: Screenshot from the film *Le Voyage dans la Lune,* Georges Méliès, *1902*

Some early but prolific examples follow the paths set since the 20th century literature with Jules Vernes and in a more exotic way with Herbert George Wells. This english writers' famous book "The war of the worlds" featuring the earth invasion by martians, and composed by the volumes "The coming of the martians" and "The earth under the martians", constitute some of the most commented science fiction books (Parrinder, 2000). Its influence ranges from cinema to ecology, touching social analysis using neo-darwinian derivations and even politics. This opus has many adaptations, from radio dramas to cinema adaptations, from Byron Haskin in 1953 to Steven Spielberg in 2005. Probably the most known radio drama was the Orson Welles' 1938 broadcast narration that induced panic in many listeners who believed the events described in the program were news about a real martian invasion.

Fig. 2: Henrique Alvim Corrêa's illustration for the belgian edition "*The war of the worlds*", 1906.

Although Welles delivered a public apology in a press conference for the induced mass fear of the American public, this performance brought him immediate fame: "*I had every hope that the people would be excited as they would be at a melodrama (...)"* - he explained. "*We are deeply shocked and deeply regretful about the results of last night's broadcast."* (Welles, 1997).

Fig. 3: *War Of The Worlds* broadcast and copy of a newspaper reporting it - © The New York Times

When exploring space became reality

Not surprisingly, Robert H. Goddard, who dedicated his life to rocket engineering research but didn't live to see the age of spaceflight, although recognised as the father of modern rocketry, was deeply influenced by *War of the Worlds* novel while teenager. His work ultimately lead to many feats like the Apollo program which accomplished landing on the Moon, the landing of robotic probes on Mars, flybys of Venus and Mercury, and to space probe's flybys of Jupiter and Saturn by the Voyager missions with their Golden Record carrying a message from Humanity: "a bottle into the cosmic ocean" (Sagan, 1978).

The Moon landing event had extensive worldwide coverage by television channels enabling the real-time follow up, for the first time, of a defining event for Humanity: the crossing of a new frontier, stepping on a cosmic body outside the Earth. As an example of the media and public excitement, the BBC transmitted for nine enthusiastic and consecutive days, in an attempt to provide scientific and technical explanations to the general public and reporting in detail the major mission moments.

Fig. 4: Screenshot of the BBC *Apollo 11* studio, broadcast on BBC One, 1969.

The BBC broadcast was performed from the BT Goonhilly giant Antenna 1, or "Arthur[1]", the world's first parabolic satellite communications antenna, located in Cornwall, United Kingdom. Arthur broadcasted to the European Broadcasting Union network the pictures of the Apollo 11 landing in the Moon's Sea of Tranquility

[1] Goonhilly large dish antennas are named after characters in Arthurian legend, much of which takes place in Cornwall: Arthur, Merlin, Guinevere, Tristan and Isolde.

after receiving by satellite the retransmission from the NASA Deep Space Network. We should note this communication feat is tributary to the communications geostationary satellite concept that was proposed earlier by Arthur C. Clarke, known science fiction writer, science writer and visionary and also much influential to the Kubrick's film *2001: Space Odyssey*. Later on, Goonhilly became also known for another feat profiting from the advances of the Space Age and its geostationary satellites: the satellite broadcast and retransmissions of the 1985 Live-Aid concert reaching 1.9 billion people across 150 nations. This Satcom base was meanwhile decommissioned from BT, becoming the Goonhilly Earth Station, home to radio astronomy and space sciences, developing technology and outreach services to a broader community of potential users of Square Kilometer Array project (SKA), that will be explained in a later section.

Futuristic visions: enhancing reality perceptions

Stanely's Kubrick cosmic opus *2001: Space Odyssey* was created in 1968, with the screenplay co-written by Arthur C. Clarke, as already mentioned a sci-fi writer, since he was the author of the short story *The sentinel* that initially inspired the movie creation. This MGM production describes the adventures of a voyage to Jupiter in a spacecraft commanded by the computer HAL 9000 after the discovery of a mysterious black monolith, that has observed and conditioned human evolution. The concepts of artificial intelligence, technology, human evolution and extraterrestrial intelligence are the dominant film lines in a fresh reminder of the 20th century 60's and 70's decades discussions enriched by the recent feats of the spatial programs. Space Odyssey became a cult film, depicting space flight with high accuracy and some pioneering special effects, with an epic initial scene featuring the Strauss music *Also Sprach Zarathustra*. 2001 also takes full advantage of the then new 2.35:1 aspect ratio to enhance the effect of the singularity of humans in the vast outreaches of space.

Fig. 5: Screenshot of *2001: Space Odyssey* - © MGM

For the movie production, the Kubrick's team took advanced consulting by teams and companies that would later much influence the rising of sci-fi film industry (Ordway, 2001). The film consulted IBM, Honeywell, RCA and General Electric, among others, on their predictions of the spacecraft technology path for the following decades. The 2001 team counted for instance with Frederick I. Ordway III, Chief of Space Information Systems at NASA Marshall Space Flight Center, to design the spaceship; with the Werner von Braun design concept of a orbital wheel rotating space station; Harry Lange, as the illustrator and concept artist, that years later designed the spaceship interiors for Star Wars movie; and with Tony Masters, the production designer on *Lawrence of Arabia*, *Dune*, etc. *Space Odyssey* follows its precursor, the soviet film "*Road to the stars*" directed by Pavel Klushantsev in 1957, a film credited by many to be the first to consider new innovative special effects describing space flight, life in space and rocket science, based on the life of space pioneers Konstantin Tsiolkovsky, Max Valier and Robert Goddard. For example, the wheel-shaped space station was shown eleven years before Kubrick's film and its techniques to film the space weightlessness became a reference, as we can now perceive so well in the 2013 film Gravity, directed by Alberto Cuaron and featuring Sandra Bullock and George Clooney floating in space trying to escape a catastrophic burst of orbiting space debris. In *American Cinematographer 1994* it is claimed Klushantsev has preceded Stanley Kubrick to fly actor/astronauts on wires with the camera on the ground, shooting vertically while the actor's body covered the wires (Klushantsev, 1994). Gravity on the other hand, besides a 12 wire puppet frame to position the actors *a la Kubrick-Klushantsev* style, uses sophisticated and very demanding computer generated spacewalk scenes (Jackson, 2014): nearly 3 years of the 4 and half years needed to produce Alberto Cuaron's film were passed in computer-generated imagery (CGI) rooms". CGI is now assisted by Cloud computing technology, providing the necessary rendering horsepower to artists, designers and developers. Desktop as a Service (DaaS) frameworks combined with distributed high-performance graphics-accelerated computing power and Virtual Machine Ware are nowadays necessary to produce highly realistic sequences. As in (Bodhani, 2014): "*CGI no longer has to look realistic – it has to look real*". Ultimately, SKA will take its own share of Cloud Computing technologies to new levels to help process and store its huge Exabyte a day of data flow, and visualise and image sky data, thus potentiating new tools that entertainment industries will also benefit. For such endeavour, very recently SKA and Amazon Web Services agreed on a first "AstroCompute in the Cloud" grant for innovative cloud computing solutions to explore ever-increasing amounts of astronomy data in ways that were previously unimaginable: *Seeing the Stars through the Cloud* (Garnier 2015).

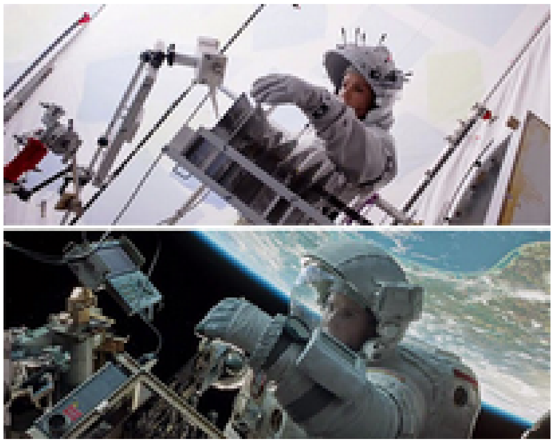

Fig. 6: Scene before and after special effects, Gravity - © Warner Bros. Pictures / Esperanto Filmoj / Heyday Films

Astronomy and cinema: a mutual influence

For the last 30 years, radio telescopes have routinely detected many pulsars and the associated phenomena, including the Very Large Array Telescope (VLA) located in New Mexico, USA with its 27 large radio antennas and the giant 300-meter located in Arecibo, Puerto Rico These objects became part of the common cosmic fauna, and fortunately, now it is possible for the general public to recognise the VLA and the Arecibo telescope after watching *Contact* film, 1997, directed by Robert Zemeckis and featuring Jodie Foster in the role of a SETI (Search for ExtraTerrestrial Intelligence) project scientist who finds strong evidence of extraterrestrial life and is chosen to make the first contact after travelling through wormhole tunnels, space time singularities described by the general relativity theory.

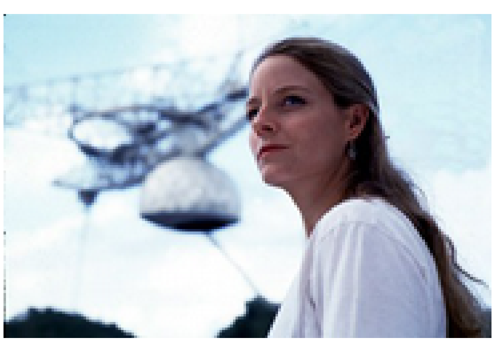

Fig. 7: Screenshot from Contact movie with Arecibo radio telescope in the background - © Warner Bros. Pictures / South Side Amusement Company

Today's NASA Goddard Space Flight Center (GFSC) is the largest NASA lab building spacecraft to travel through our solar system and study the deep universe. GFSC is responsible for such human endeavours like the Hubble Space Telescope or its near future successor, the James Webb telescope. The payback of this almost 100 year old story came after the Space Telescope Science Institute (STScI) produced the "Hubble 3D" in 2010, a documentary that takes the viewers to a journey through the Universe from the neighbourhood of our Solar System to faraway galaxies. Narrated by Leonardo Di Caprio and produced by Tony Myers and its filmmaking team, this IMAX 3D motion picture film expressed a story "full of hope, crushing disappointment, dazzling ingenuity, bravery, and triumph", according to its synopsis. This is after all the universal drama leitmotiv of sci-fi cinema entertainment.

Fig. 8: Poster of the documentary Hubble 3D - © NASA / Warner Bros. Pictures / IMAX Filmed Entertainment

Another recent example of this mutual relation between science and the seventh art is the film Interstellar, released in 2014, picturing space travel through wormholes and around black holes (BH). The most striking scene shows a glowing accretion disk appearing around a BH, reminding Jean-Piere Luminet's pioneering work (Luminet, 1979). He was the first researcher to perform the general relatively numerical calculations and to simulate the optical distortions caused by the gravitational field of a black hole surrounded by a thin accretion disk, in order to visualise this invisible element in the universe without the aid of modern computing tools (Luminet, 2015).

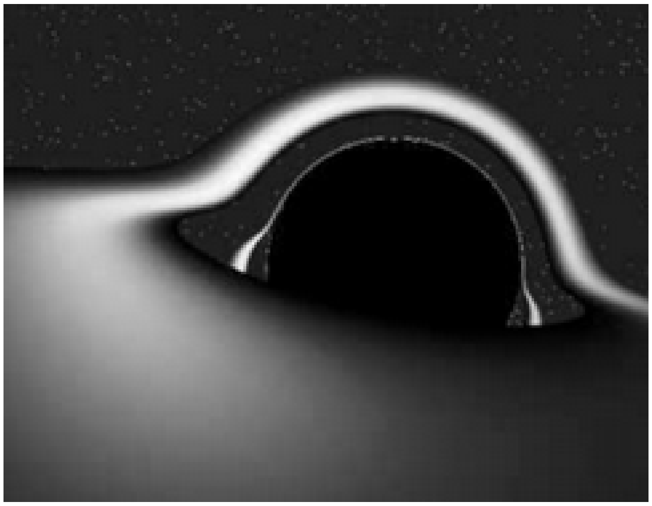

Fig. 9: Luminet's image of a spherical black hole with thin accretion disk - © J.A.Marck/Sygma

After more than three decades, the general public could watch an accurate representation of these phenomenon in a movie: Christopher Nolan, the film director had a consultant, the physicist Kip Thorne, a distinguished specialist in general relativity and black hole theory. The To ensure a close scientific realism, black holes - places where the force of gravity is so extreme that it overwhelms all other forces in the Universe, and nothing can escape its interior, not even light (Luminet, 2015) - were simulated and then illustrated by the team of visual special effects company Double Negative. Not surprisingly, Interstellar glowing black hole imagery is reminiscent of the published Luminet's science images.

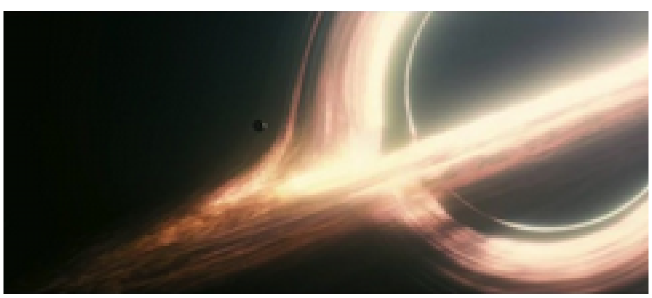

Fig 10: Screenshot of Interstellar movie picturing a black hole - © Paramount Pictures/Warner Bros. Pictures

It is believed that one of the best ways of representing a body is by its image, by photographing or filming it. It may seem impossible to represent a black hole, since no material, not even light, can escape it. However, it can be photographed under spotlights, because even without emitting light, accordingly to the theory it is possible to perceive a black hole if it is illuminated in a way that it sends back the light which was received (Luminet, 2015). This is certainly the case for another strange manifestation of matter in the Universe: pulsars, a highly magnetized neutron star. This cosmic object the size of the Earth, but with the mass of the Sun, spins fast - less than a second per rotation - throwing its periodic radio beacon into space with a precision higher than an atomic clock. Pulsars are a remnant of supernovae, the explosion of a dying star, discovered in 1967 by Jocelyn Bell Burnell and Antony Hewish after detecting their periodic pulses with a radio telescope (Hewish, 1968). Among the several hypotheses developed to explain these faint, highly periodic radio signals, pulsar signals were also thought to be a manifestation of an extraterrestrial civilization, the signal was even dubbed LGM-1 (Little Green Man 1), before a more natural explanation, but no less fantastic, was confirmed. Indeed, this discovery was awarded the physics Nobel prize.

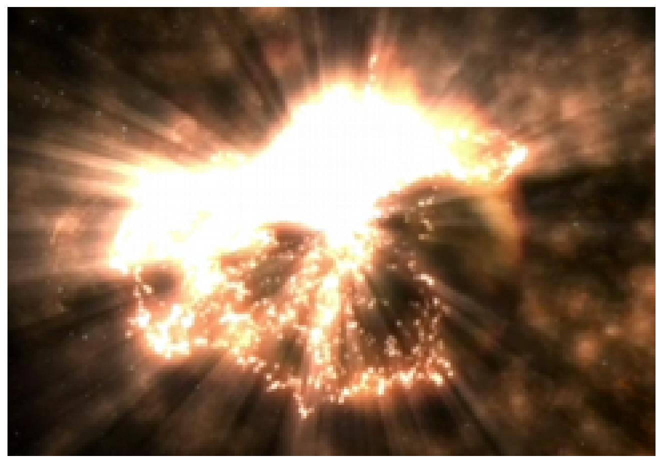

Fig. 11: Representation of a Supernova, screenshot of Beautiful Minds Series - © BBC

Square Kilometre Array project

The SKA project began in the year of 1993, when the International Union of Radio Science (URSI) established the Large Telescope Working Group to start a worldwide effort to work on scientific goals and technical specifications for a next generation radio observatory. The project aim to build an international multi purpose next-generation radio interferometer, an Information and Communication Technology (ICT) machine with thousands of antennas linked together to provide a collecting area of one square kilometer (Schilizzi et al. 2008).

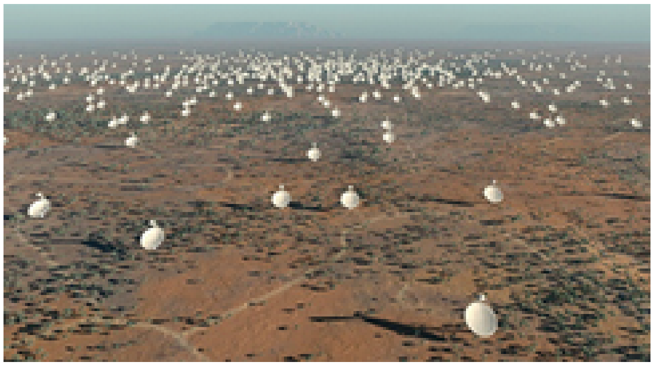

Fig. 12: An artistic vision of the SKA Core site, with some of the projected 2000 15-meter parabolic dishes - © SKA Organisation

In terms of science, SKA will be built to investigate the nature of the first stars in the Universe, the cosmic history of the Universe, the nature of Dark Matter and Dark Energy, theories of gravity and black holes and the origin of cosmic magnetism. Essentially answering questions regarding how our universe was created and evolved until our present time.

Testing theories of gravity will rely on the observations of about 100.000 pulsars in our Galaxy. SKA will be so sensitive, it could detect an airport radar from an advanced civilization up to tens of light years away - there are around 133 star systems in this radius. Supermassive Black Holes (SBH) on the other hand are a key ingredient of almost all big radio galaxies in the Universe, governing most of the matter accretion and galaxies evolution. By mapping almost one billion galaxy, SKA will reveal the signatures of many of the SBHs in the observable Universe.

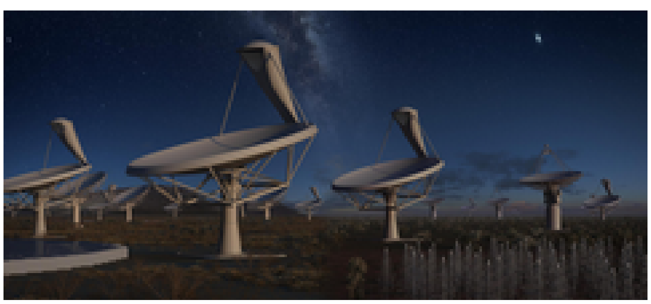

Fig. 13: An artistic vision of the SKA at night - © SKA Organisation

Furthermore, SKA builds up on technologies developed for previous radio telescopes, including the SETI project, a pioneering Internet experiment for distributed analysis of radio astronomical data. These data techniques have much contributed in the long run to enrich, not only computer science, but also medicine, chemistry and biology.

The SKA research infrastructure is likely to become "a lighthouse project for global cooperation in many 'frontier' domains of the 21st century" (COST Report, 2010), and will be a playground for the development of several technologies that will leak to the general society.

Nowadays, the cinema industry is also a heavy user of distributed compute-intensive and data-intensive applications for audio and visual effects requiring powerful compute horsepower: complex rendering, high-definition video sequences, and innovative special effects are a very sizeable part of the creative and production budgets for modern film projects. Interestingly, many technology and concepts can be shared between special effects systems and radio astronomy processing systems.

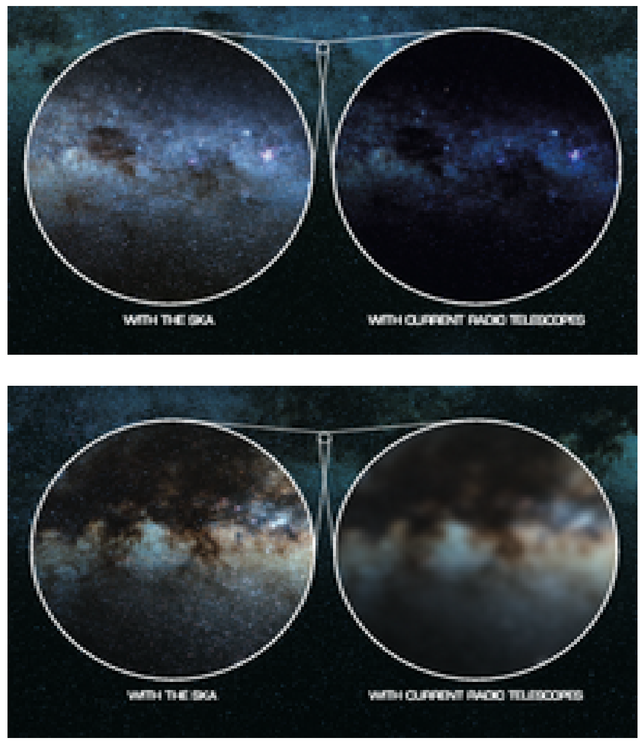

Fig. 14: Comparison of resolution (top) and sensitivity (bottom) between SKA and radio telescopes nowadays - © SKA Organisation

SKA: Made Global

The SKA is the only global project in the European Strategy Forum of Research Infrastructures, with 11 Full members - Australia, Canada, China, Germany, India, Italy, New Zealand, South Africa, Sweden, The Netherlands and the United Kingdom. In a global perspective, SKA involves more than 100 organizations in 20 countries, counting with world-leading ICT industrial partners.

The SKA will be located in the Southern Hemisphere in high solar irradiated zones, South Africa and Australia, with distant stations in the SKA African Partners, like Botswana, Ghana, Kenya, Madagascar, Mauritius, Mozambique, Namibia and Zambia. In Africa, it can be best described as a central core of ~200 km diameter, with 3 spiral arms of electrical and optical infrastructure connecting nodes of antennas spreading over sparse territories in several countries up to 3000km distances, all in high solar irradiance latitudes. In Australia, the low frequency array will consist of thousands of stations spread over a few hundred kilometres. Each station will be made up of some 260 antennas similar to TV aerials and about 2m in height. SKA is planned in two construction phases, with deployment of different antennas starting with Phase 1 in 2018 for a cost of 650M€. The first science observations with the SKA are expected in 2020.

Fig. 15: Artistic rendition of SKA dishes, including MeerKAT dishes built in South Africa - © SKA Organisation

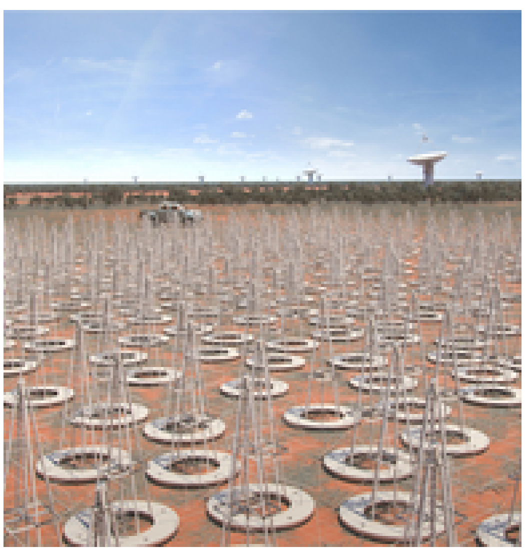

Fig. 16: Close up of an artistic rendition of SKA Low frequency aperture array in Australia - © SKA Organisation

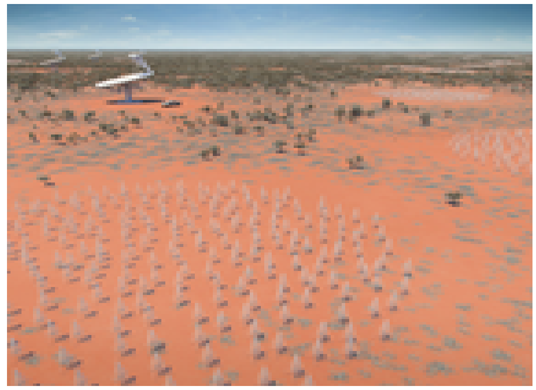

Fig. 17: Artistic impression showing a wide field view of the hundreds of thousands of antennas that will be deployed in the Australian Murchison region - © SKA Organisation

SKA impact in society

SKA will generate for the next 30 years - at least - many scientific, engineering, societal and socioeconomic benefits. A number of societal impacts are expected, not only from the obvious economic benefits for those participating in the infrastructure construction and the Big Data technologies developments. It will be listed only a few of them from the official report on SKA (COST Report, 2010):

a) SKA will be a major driver for innovation in ICT since it is expected to generate more than 10 times the current amount of Internet data traffic. The expected benefits will involve not only signal processing, storage and computation, but also reliability and maintainability for remote SKA use, providing a backbone for development of the ICT commercial services. These will include the precursor of technologies for novel wireless technologies. The same long distance (3000 Km) very high bandwidth optical technologies are reused for high density 5G mobile deployments, benefiting most of the society.

b) The SKA will drive innovation in wireless communication through hardware development of extremely low noise amplifiers (LNAs), which are used to detect and amplify faint radio signals, and analog-to-digital converters (ADCs), which are used to convert the amplified signals into digital form for processing and storage. LNAs and ADCs are important in virtually all types of digital electronics and communications technologies. A better LNA means a more sensitive receiver inside cell phones and relay towers, and that means better fidelity of the signals and longer range transmissions. The associated microelectronics is important for all wireless communication, and a good guess is that in 10 years, nearly everything that is built will have wireless capabilities. Better LNAs and ADCs also means better health monitoring devices like glucose meters, more precise food or toxicological analysis equipment, better weather and geological monitoring devices, and better X-rays and MRI.

c) A strong focus of the SKA is reducing the operational costs due to energy consumption. The reduction of the SKA carbon footprint requires the development of innovative strategies combining power efficiency gains in electronics and intelligent data center management towards Greener Processing and Storage centers and the availability of a Greener power mix. Solar Energy is being investigated as one of the power supply options to mega science projects in remote, highly irradiated locations. It is expected SKA will set an example of a Green machine during its lifetime, and promote energy best practices for society. In fact, the same technology that will power the clusters of antennas from combined power sources (solar, wind, fuel, etc.) is expected to be replicated at isolated towns throughout Africa and other remote areas, providing a clear benefit for the promoters of such technologies, but also to the populations living in those areas. Without this type of solutions, a relevant percentage of the world's inhabitants will stay deprived of basic conditions for living with environmental and food security.

d) An also important aspect is the Education and Human Capacity, as well as its spinoffs. Unlike many of the other mega-projects, SKA brings in the developing world into the world stage of science. The design, construction and operation of the SKA, including the development and maintenance of the its digital backbone, the power supply infrastructure, including green energy, will generate employment and education opportunities. Furthermore, SKA expected operational lifetime, its global nature, will act as a cluster for collaboration. Solar Energy is being investigated as one of the power supply options for the SKA. In order to be used, green energy technology needs to be mature enough to power such a large infrastructure reliably and needs to be financially sensible, being available at a lower cost than traditional energy sources. If implemented, mature green energy solutions deployed for the SKA could set an example and promote energy best practices in large-scale research infrastructures.

For all participants, there are clear benefits to this collaboration. For the countries that are participating in the design process, and will participate in the construction phase, the SKA represents the reinforcement of bilateral relations between nations. Also, the scientific, engineering and enterprises will collaborate and exchange experience, know-how and designs, in other to best built the SKA. It should be remembered that is not clear how all components are going to be built, or what technology will be used as, in some particular cases, there may be the case that such technology doesn't exist yet, doesn't have the required performance, or lacks the required energy budget.
Countries that will not host the instrument will benefit from the opportunity to see their enterprises develop new technologies that will be exported, first to SKA, and then to other related areas. The result will be a favourable economy balance (due to increased exports), the opportunity for highly specialised engineering and scientific education, as well as a situation where human resources and technology is exchanged between nations. Moreover, several key systems are expected to be deployed in additional countries, either to assist the local scientific community by providing specialised processing facilities, or to accelerate access to data by providing local caching. In both cases the technology and infrastructures can be extensively reused for other sciences like medicine or integrated as support infrastructures for higher education studies.

For the hosting nations, the SKA constitutes a major breakthrough, having an important impact in the forge of future politics, as well as economical, societal and scientific advances. Having a globally supported infrastructure, with a lifetime of several decades, capable of clustering the best researchers in a specific area, is a privilege capable of greatly fostering the science produced in a nation.

Exploring through visuals

As it is clear, the SKA project will be the biggest instrument for science knowledge production and dissemination ever built. Different high-tech companies are working on high definition (1080p) animations and renderings in Stereo 3D and 2D using supercomputers to create breathtaking visuals of the SKA. Soon, these images will turn to a real infrastructure during the construction phase that should be documented and disseminated worldwide. The outreach materials should typify the excellent engineering and technical capabilities gathered from all around the world, as science knows no borders (Ramaphosa, 2015).
Communication materials about science and engineering challenges and achievements are being carefully created to meet the general public understanding with scientific accuracy. Public awareness of science is more easily achieved when the materials target a specific audience with the focus

on the relevant data and avoid technical details, when they are designed with the aesthetic sensitivity, and finally if they take in consideration the audience perspective. And when it comes to movies, opportunity windows do emerge when sci-fi audience watches frontier science related screenplays. Suddenly, large scale science facilities became part of the popular culture through action films like James Bond movies - Quantum of Solace, recorded at European Southern Observatory's Very Large Telescope facilities in the Andes, Chile, GoldenEye at the Arecibo Radiotelescope in Puerto Rico - or the Hulk movie that had some background scenery shoot in the Advanced Light Source of the Lawrence Berkeley National Laboratory, USA. In this respect, CERN hosts a reference initiative, the CineGlobe International Film Festival, an annual event promoting the convergence between art and science through films telling stories inspired by science and technology. Paraphrasing this festival's artistic Director, Neal Hartmann: "*Times are changing fast, which is why the theme of this year's festival is Beyond the Frontier, casting the spotlight on how science and cinema are at a crossroads, passing into a world that will be fundamentally different than what we have known before*" (Navi 2014).
It is also important to report the impact of this project on the local communities, and how they are being engaged. Taking for example the art/astronomy collaborative exhibition entitled *Shared Sky,* that the SKA project launched, with official opening in September of 2014 in Perth, Australia, followed by a new inauguration in February of 2015 in Cape Town, South Africa. This collection stems from a vision to bring together under one sky Aboriginal Australian and South African artists, reflecting the richness of their ancestor's understanding of the world developed across countless generations observing the movements of the sky. This vision embodies the spirit of the international science and engineering collaboration that is the SKA project itself.

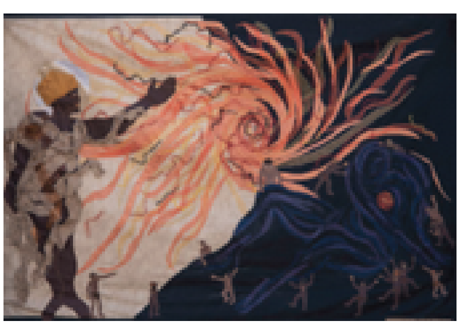

Fig. 18: South African work of art from *Shared Sky* collection - © Shared Sky – Bethesda Arts Centre

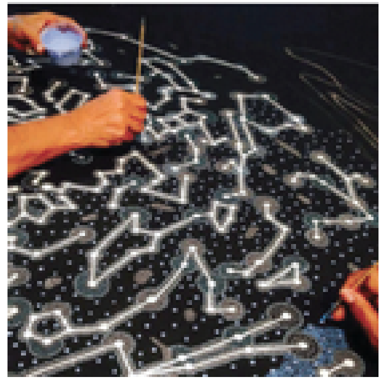

Fig. 20: Australian Aboriginal collaborative work being developed for *Shared Sky* collection - © Shared Sky – Yamaji Art

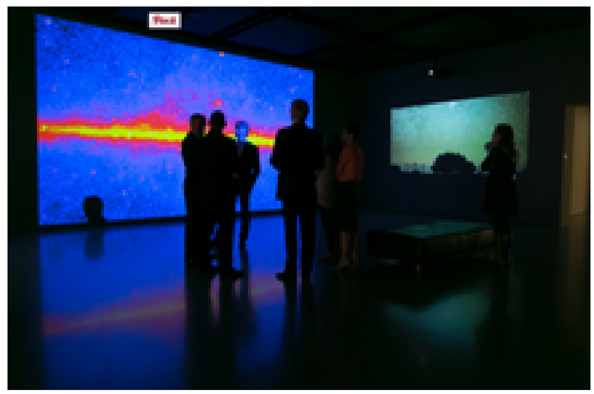

Fig. 19: Photo taken during the Shared Sky exhibition where some visuals were publicly displayed - © SKA Organisation

Interactive narratives to raise public awareness about SKA

Storytelling is one of the oldest human activities, a simple process used by human beings to better explain and easily understand the world (Murray, 2003), many times preserving important information and myths through generations. Storytellers have been improving their art according to technological innovations (Correia et al., 2005), and nowadays, every digital device can be used to record and tell a story, in an ever-growing toolbox (Alexander, 2011). The digital technology allows the story to become interactive by enabling a back-and-forth communication between the audience and the narrative material (Miller, 2008). Digital storytelling allows new types of narratives and the widespread of stories across the world (Correia et al., 2005).
The knowledge that can emerge from those narratives can be used to raise public awareness, and there are several digital storytelling related projects dealing mainly with social and educational aspects, studying

the digital technologies as a means to approach people, to promote collaborative learning and cultural dissemination. However there is the need for a study on raising public awareness of science regarding large scale projects and targeting specific audiences.

There is a collective need to do more to take science to those not currently involved and to interact with people where they naturally congregate, rather than expecting them to come to the science spaces (BIS, 2015). In this respect, SKA can be a case study as a large scale project, outreach materials regarding the challenges and achievements of this global project will be carefully created to meet the general public understanding and its expectations, to clarify the project importance into political agendas, to foster industrial investment, and to unite the scientific community, while preserving scientific accuracy.

Furthermore, it is important to promote active communication about science in the public arena, and digital media does have a key role to encourage informed mass decisions about scientific issues that may concern everyone. Interactive narratives should typify the excellent engineering and technical capabilities gathered from all around the world, and scientific projects, like SKA, should be explained in new ways to excite the imagination of the public (CPAS, 2015).

Conclusion

The SKA project is more than a science project and can easily be documented as a laboratory for innovations in radio communications, data transport, smart information processing, storage, and worldwide dissemination of knowledge. Its impact on society will cover as much as possible many areas by developing creative synergies between scientists, engineers, and business and industrial partners. Some of the innovations will contribute towards new ways of processing information, that ultimately may change the way society communicates. In the end, entertainment and its creative industries will immensely benefit from the exposure to the technology advancements generated by mega projects like the SKA.

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