

Space, the Final Frontier

A Wednesday Chapel Talk. Cloister Time 2016.

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[<12 minutes. 1,430 words]

"Space: the final frontier. These are the voyages of the starship Enterprise. Its five-year mission: to explore strange new worlds, to seek out new life and new civilizations, to boldly go where no one has gone before."

This was the iconic opening line¹ during the title sequence of the *Star Trek* TV series, created by ex US Army Air Force pilot and Los Angeles policeman Gene Roddenberry. *Star Trek* was first broadcast in 1966 and has been continuously artistically re-imagined ever since. It is thought that the line may have been inspired by a White House document *Introduction to Outer Space*, published eight years earlier in 1958.²

"The first of these factors is the compelling urge of man to explore and to discover, the thrust of curiosity that leads men to try to go where no one has gone before. Most of the surface of the earth has now been explored and men now turn on the exploration of outer space as their next objective."

Although one could rightly criticize the dubious political motives of the Cold War-chilled Space Race of the Sixties and Seventies, there is no doubt that this period marked a high point in human cooperation and ingenuity. A possibly unparalleled frenzy of non-military Science and Engineering which led to Neil Armstrong's own opening line *"It's one small step for Man, one giant leap for Mankind"* as he placed the first ever human footprint upon

¹ https://en.wikipedia.org/wiki/Where_no_man_has_gone_before

² *"Introduction to Outer Space"*. The White House. U.S. Government Printing Office, Washington D.C., 26 March 1958. URL accessed on 15 August 2006.

the Moon on the 20th July 1969. Although Eugene Cernan and Harrison "Jack" Schmitt closed the Moonside door of their Apollo 17 Challenger lunar lander for the last time on the 14th December 1972, China, India, Russia are all currently planning a new chapter of human voyages to our nearest rocky satellite. Indeed, a manned mission to Mars is not merely a Hollywood fantasy. Consider the Orion project. To quote the project website³:

"For the first time in a generation, NASA is building a new human spacecraft that will usher in a new era of space exploration."

If there is suitable will, I think it is possible we will all encounter a real Martian in our lifetime. Unless body-art fashions change significantly though, I doubt these will be green, or indeed just men. It might be of practical use to be little though, so perhaps my childhood dream of being an astronaut is not quite dead yet.

The lasting appeal of Star Trek, and the myriad of tales of similar interstellar odysseys, is surely at least in part due to a fundamental fascination with the unknown, a basic human curiosity to see what is beyond our present horizons. To quote from H.P. Lovecraft in his 1927 novella *The Dream Quest of Unknown Kadath*:

"At length, sick with longing for those glittering sunset streets and cryptical hill lanes among ancient tiled roofs, nor able sleeping or waking to drive them from his mind, Carter resolved to go with bold entreaty whither no man had gone before, and dare the icy deserts through the dark to where unknown Kadath, veiled in cloud and crowned with unimagined stars, holds secret and nocturnal the onyx castle of the Great Ones."

Although the Moon landings may be the current apogee of human exploration, the associated Scientific appendices are expanding at an impressive rate. Even more than in a

³ <https://www.nasa.gov/exploration/systems/orion/about/index.html>

Tolkien novel. Remotely controlled vehicles have mapped all the planets in the Solar system, the most recent being New Horizon's spectacular intimate photoshoot of Pluto and its moon Charon in July 2015. The 7.5 billion kilometre radio umbilicus was successfully proven, perhaps unsurprising given that Voyager 1, launched in 1977, is still in contact with Earth even though it is now about 19 billion kilometres away, and receding another 61,000 km every hour.

In the last one hundred years, the detail of our understanding of the Cosmos has been nothing short of revelation. The modern Big Bang story of Genesis, intriguingly first proposed by Physicist, and Belgian Priest, Georges Lemaître, is a much grander, and humbling narrative than the Biblical original. Incredibly, Science can predict with peer reviewed precision the broad plot themes back to 10^{-43} of a second after the creation of our Universe. Seven days has become 13.8 billion years, the Earth coalescing from supernovae stardust for the latter 4.5 billion. If the Cosmic aeons could be compressed into a calendar year, our Galaxy formed in May and the Earth in September. Dinosaurs roamed the Earth from Christmas Day until the 30th December. Modern humans evolved around 11:54PM on New Year's Eve. Christ was born with about five seconds to go and Columbus arrived in America with about one second to spare. Blink, and you skip centuries.

The physical scale of the Cosmos is even more awe inspiring. The distances between stars is so vast that only by considering the propagation of light itself can we begin to assign meaning. Light takes 8.3 minutes to complete the transit from the Sun to Earth, a distance of 15 billion metres, or 374,000 times round the circumference of the Earth. The nearest star is about four light years away, 253,000 times the Earth-Sun separation. So far that even our nearest neighbour would be almost impossible to visit. Voyager 1, our fastest spacecraft to date, would take over 70,000 years to make this journey. Although future communication with an alien civilization may not be practical, we can at least be content

with the incredible opportunity to record, and learn from history. By analysing the spectrum of light received by our ever increasing array of land and space-located telescopes, we can infer the structure and composition of distant quasars over 10 billion light years away. The edge of the Universe, if that even has a meaning, is at least 45 billion light years, and expanding. When we gaze up at the night sky we are seeing an ancient tableau, thousands, millions, perhaps billions of years old. Indeed, *"A long time ago in a galaxy far, far away...."*⁴

I shall conclude with the beautiful, poetic words of the American planetary scientist Carl Sagan. I shall read the opening, and concluding lines⁵ of his wonderful book *Cosmos*. I urge all of you to read it at least once. The television series of the same name is also fantastic, and indeed Professor Brian Cox credits it as the primary inspiration for the more contemporary *BBC Wonders of the Universe* series, and perhaps why he became a Scientist in the first place.

"The Cosmos is all that is or ever was or ever will be. In the last few millennia we have made the most astonishing and unexpected discoveries about the Cosmos and our place within it, explorations that are exhilarating to consider. They remind us that humans have evolved to wonder, that understanding is a joy, that knowledge is prerequisite to survival.

I believe our future depends on how well we know this Cosmos in which we float like a mote of dust in the morning sky."

"Some 3.6 million years ago, in what is now northern Tanzania, a volcano erupted, the resulting cloud of ash covering the surrounding savannahs. In 1979, the paleoanthropologist Mary Leaky found in that ash footprints – the footprints, she

⁴ Opening line to every film in the Star Wars franchise

⁵ Carl Sagan (1934-1996). *Cosmos*. The first paragraph of the book is also the opening line to the TV series of the same name.

believes, of an early hominid, perhaps an ancestor of all the people on the Earth today. And 380,000 kilometres away, in a flat dry plain that humans have in a moment of optimism called the Sea of Tranquillity, there is another footprint, left by the first human to walk another world. We have come far in 3.6 million years, and in 4.6 billion and in 15 billion.

For we are the local embodiment of a Cosmos grown to self-awareness. We have begun to contemplate our origins: starstuff pondering the stars; organized assemblages of ten billion billion billion atoms considering the evolution of atoms; tracing the long journey by which, here at least consciousness arose. Our loyalties are to the species and the planet. We speak for Earth. Our obligation to survive is owed not just to ourselves but also to that Cosmos, ancient and vast, from which we spring."

AF. 5th April 2016.