Meeting aliens will be nothing like Star Trek—fact

May 8 2013, by Mike Lee

What use are Vulcan salutes when other life-forms see you as bacteria? Credit: Gage Skidmore

The latest Star Trek movie, opening tomorrow, raises an eternal question: why are the Klingons (or Cylons or Daleks) always at roughly our technological level?

For any sense of drama, interplanetary protagonists have to be evenly matched. Usually, the aliens have technology that is sufficiently superior to humans to promise them victory – yet not infinitely superior, thus permitting nail-biting battle scenes and humanity's eventual triumph against (almost) insurmountable odds.

But the technological progress of life on Earth – as deduced from palaeontology, archaeology and modern history – indicates this cliché makes no sense.

Should we meet aliens, they will almost certainly either be at the bacterial level, or so advanced that they would see us as bacteria. Either way, it would not be a very exciting encounter, at least by Hollywood standards.

The fossil and archaeological record emphasises the jerkiness of technological progress on Earth. Life has existed on earth for more than 3.5 billion (3500 million) years, but was at the microbial level for 85% of this time.

Tools were only invented in the past couple of million years, by a select few species (such as humans, chimps and Caledonian crows).

Technology – complex tools – is unique to humans and only appeared in the past few thousand years. But when technology finally appeared after aeons, innovation accelerated exponentially.

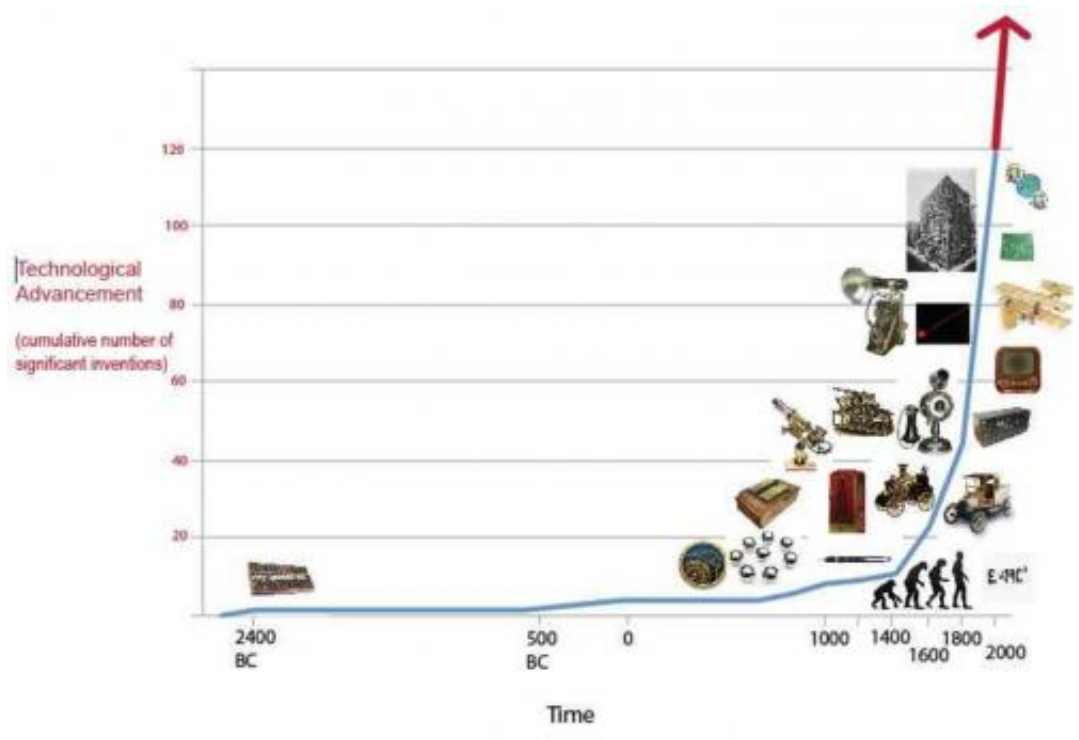
I quantified this exponential growth by consulting a detailed timeline of modern inventions: a list of game-changing technological breakthroughs that transformed society, such as the printing press, antibiotics, the car, the aeroplane, TV and the internet (any such list has inherent subjectivity, so you might want to find your own).

I plotted the cumulative amount of technology available to humanity through time based on this list: so, for instance, the earliest piece of technology on the list (the abacus) appeared around 2400BC, so humanity's (and Earth's) technological "score" finally moves up to 1 at that time, after being stuck at 0 since the origin of life.

The resultant graph of technological progress shows innovation proceeds rather slowly until about 1400AD, and then really takes off.

Between 1400 and 1600, there were 12 revolutionary innovations, which exceeded the number of such innovations in the entirety of human existence (and thus Earth's existence) up to that point.

Between 1600 and 1800, there were 21 such inventions; and between 1800 and 2000 there were 75.



The accelerating growth of technology, which has doubled every 200 years since 1400. Credit: Michael Lee, SA Museum

Technology is growing exponentially, and since 1400 has doubled every 200 years (analogous to a computing phenomenon known as Moore's

law, applied across all technology).

The next double-century (2000-2200) therefore promises no fewer than 150 breakthrough innovations on par with the steam engine, antibiotics and the aeroplane. No wonder technophobes moan "stop the world, I want go get off".

This exponential growth is no surprise. Innovation is a positive feedback process. Every invention sets in train further innovations, which can further drive elaboration of the original invention.

Think of inventions that improve communication (eg writing, print, telephone, radio, TV, internet). Better communication means ideas circulate much more rapidly, interact and synergise, resulting in further innovation, which in turn quickly yields even further improvements to communication.

Every invention relies on, and sets the groundwork for, other innovations, though some links are not immediately obvious.

The technology to build tall buildings has existed for many thousands of years, as evidenced by the massive temples and columns of the ancient world. Yet the first skyscraper – the first inhabited tall building – only appeared Chicago as late as the 1880s.

It was built shortly after the invention of the lift and the powered industrial water pump.

This is logical: a skyscraper would not be very popular if there were no lifts, and the toilets were on the ground floor. So an efficient water pump, as much as the lift, made possible the skyscraper. And of course, as those buildings got ever taller, the pressure to improve pumps increased.

Once life on any planet – such as Earth – hits upon technology, the rate of change will rapidly and continuously accelerate, and society will spend less and less time at any particular technological level.

Humans spent more than two million years at roughly the same stone-age level: transplant a palaeolithic caveman 100,000 years into his past or future, and he probably wouldn't notice any change.

But imagine the angst that would result if you put a teenager 50 years into her past, or yourself 50 years into the future. Things are now changing faster than ever, and the pace of progress will only increase.

Our current technological level will probably span about 100 years, from 1950 to 2050: daily life before and after this period will be qualitatively different.

Archaeologists of the future, and palaeontologists from the very distant future, will look upon this period as a unique period in human (and Earth) history, and perhaps label it the "palaeodigital age": the age when life first made crude digital tools (such as plastic watches, Pac-Man machines and iPads).

If evolution on alien worlds proceeds even vaguely like that on Earth, then extraterrestrial life, too, will be stuck at zero technology for eons.

When technology finally appears, it will hurtle forwards with increasing momentum so that life spends short (and increasingly shorter) intervals at any particular technological level.

Even a slight time displacement on this steep learning curve translates to monumental differences in technological capability. For instance, the end of the age of sail was separated from the beginning of the space age by less than a century.

And human societies, which all shared similar tools until some left Africa perhaps 60,000 years ago, diverged sharply in technological advancement very rapidly, resulting in grossly unequal encounters during the Age of Exploration.

There is therefore effectively zero chance of meeting an alien society at the fleeting moment that it happens to occupy a similar point on the technological learning curve as humanity.

Rather, any inhabited alien world we encounter will either be filled with bacteria – or brimming with technology advanced far beyond our comprehension.

And, of course, neither scenario would make for a very exciting movie.

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