

Evo-SETI Scale for Exoplanets hosting Life

Claudio Maccone

Director for Scientific Space Exploration, International Academy of Astronautics (IAA, Paris),
Chair, IAA SETI Permanent Committee,
Associate, Istituto Nazionale di Astrofisica (INAF, Italy).

E-mail: clmaccon@libero.it

Abstract.

The Evo-SETI Scale (Evo-SETI stands for “Evolution and SETI”) is a scale of information measured in bits.

It ranges between zero (corresponding to the time of the origin of life on Earth, 3.5 billion years ago or a little more, like 3.8 billion years ago, or so) and 25,575 bits, that is today’s value of the scale.

The straight line between these two values is the Scale measuring the EvoEntropy, i.e. the Shannon Entropy of Information Theory for a family of lognormal probability densities constrained between the time axis and the exponential curve representing the number of Species living on Earth at each instant between 3.5 billion years ago and now. In reality, this exponential is rather the mean value of the number of living Species in the 3.5 billion years of time, since many Species went extinct in the past. Mathematically speaking, we thus have a stochastic process with this exponential mean value and this is called Geometric Brownian Motion (GBM). This GBM turns out to be a lognormal process, and not a Gaussian process.

The relevant mathematics is rather difficult, and was developed by this author in a series of some ten mathematical papers published in the International Journal of Astrobiology and in Acta Astronautica since 2010.

But the meaning of the Evo-Scale is quite neat: it shows “how much evolved” a certain Species is with respect to all other Species, both of the past and of the present. And if we replace “Species” with “Complexity”, the Evo-SETI scale becomes the Complexity Scale that we can extrapolate into the future in order to find how much more complex than Humans a certain ET Civilization will turn out to be when SETI, the Search for ExtraTerrestrial Intelligence, will put us in touch with Alien Civilizations.

In conclusion, our Scale really is an Evo-SETI Scale, combining both the past (Evolution) and the future (SETI) into a unique mathematical scheme.

C. Maccone / Acta Astronautica 121 (2016) 306–313

313

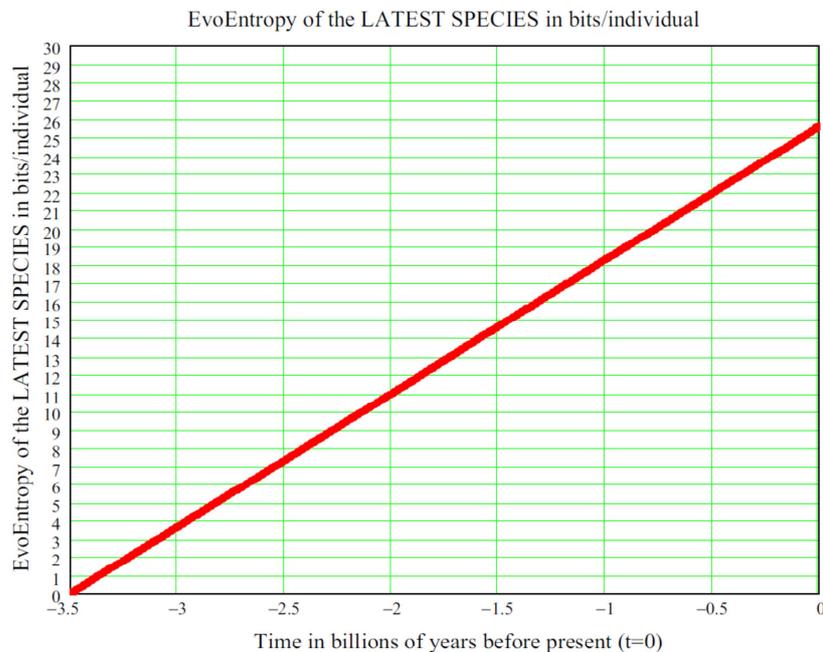


Fig. 3. EvoEntropy (in bits per individual) of the latest species appeared on Earth during the last 3.5 billion years. This shows that a Man (nowadays) is 25.575 bits more evolved than the first form of life (RNA?) 3.5 billion years ago.