

Life definition

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Abstract

I try a Life definition that does not depend on the dynamics laws (chemical, physical, logical, mechanical, biological, etc.).

I try to measure experimentally the Life.

I think that Life is an engine (an abstract machine that transform entropy) near a critical point, so that the simplest Life is a chemical oscillation near a critical point (the correlation function tend to infinity in the critical point, so that there are long range interactions in the system, and little perturbation affect the Life).

The Consciousness and the Life definition seem the same concept (for me Consciousness=Life in this article) so that wakefulness seem to exists in a brain and in a cell; the g-protein and the senses, the neurons and the metabolic pathway, the chemical thought in the brain and the signal pathways in the cell are very similar.

I extend the classical definition of engine to a system that generates a flow of entropy, so that the definition includes a myriad of possible environments for the Life: each theoretical field where there is the entropy is a field for the Life; for example computer software, search engine, mechanical system, thermodynamics, quantum system, etc.

The simplest chemical Life could be the Belousov-Zhabotinsky reaction where the mechanical shaken change the macrostate of the system (elementary Life change of state), or the oscillating Sal'nikov reaction: this is a sense without reasoning, the Life form with lowest entropy (a Shannon entropy equal to 1, or Huffman code 0 or 1).

The measure of Consciousness could be the measurement methods used in medicine, for example the Lempel-Ziv entropy of the electroencealography, but I think that a best measure is the entropy of the Huffman codes of the electric signal: the entropy is an

universal measure for probabilistic systems, so that the Life measure is ubiquitous, and the optimal compression of the measured function (state function or intensive function) in the time give a measure of Life: the Life measure change in the time, so that it is a dynamic variable of each statistical system, material or immaterial.

I think that each lossless data compression in a file give a measure of entropy complexity of the signal equal to the lenght of the compressed file in bits, so that it is possible to use free lossless codec to measure Life (it could be possible to change the time scale to use the audio frequencies constraints, because of some Life could live in different time scale, for example trees, corals, escherichia coli, methanococcus, etc.): a best Life measure could be the

$$Life = \frac{S_2 - S_1}{t_2 - t_1} \quad (1)$$

the rate of change of the entropy over time; this is a more correct measurement of the Life, because this value is interval independent; a perfect noisy signal is not compressible, so that there is maximum entropy, and a constant signal has entropy 0; each value between maximum entropy and 0, near a critical point (oscillation), is a Life.

It is possible to use a more correct measure using the zero crossing rate to evaluate the dominant frequency of the signal, so that the tree cycle, the methanococcus bacteria have a Life measure with the same number of zero crossing:

$$\begin{aligned} \sum_{t=1}^{N-1} V(t) &= 0 \\ ZCR &= \frac{1}{N-1} \sum_{t=1}^{N-1} [sign(V(t)) - sign(V((t-1)))] = M \\ Life &= (S_2 - S_1) \frac{T}{\pi} N \end{aligned} \quad (2)$$

where N is the number of samples that has M zero crossing, and T is the sampling time: each entropy measure has the same approximate number of oscillations, with $T_2 - T_1$ that can be nanoseconds (softwares), years (tree) or millennia (possible hypothetical Lives).

The higher the entropy, the higher is the complexity of the Life because of the lenght of the source code that describe the thought: the thought is each change in a statistical system near a critical point in a open statistical system (like an open thermodynamic system). The "Cogito, ergo sum" idea could give closed system for Life, but generally the Life system are open: each engine have a heat reservoir, so that a Life lives in an environment.

A critical point is a statistical point, so that the Life is an emergent property that need many interacting object.

References

D. Oricchio. "Life definition", vixra, 2016, viXra:1601.0160