Information in the Universe Increases: A Hypothesis

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The net entropy of the universe, understood as level of complexity or order, is not increasing as time goes by, as postulated by thermodynamics, because new information is continuously being generated at all system levels and added to the grand total of the universe's information bank.

What is happening with the universe? The current scientific understanding is that the changes taking place across the known cosmos slowly but inevitably lead to a state of maximum entropy. This means the majority of cosmologists, physicists and other scientists believe the universe will eventually exhaust itself after it has expended work on accomplishing all the various permutations of physical, chemical, electromagnetic, geological, spacial, and biological evolutions.

The term evolution is here used in its more generic sense, meaning any change in the configuration of a system. The more specific use of the term evolution employed in biological sciences is concerned with changes that lead to greater diversity and complexity – in other words, an increased order of organisation at any level of a biological system that occurs over time and space. But this way of understanding evolution fails to consider changes within (or of) a system which cannot be readily described in terms of greater diversity or increased complexity. Namely, if a system is observed not to change into a state of higher complexity, degree of organisation and order, it is considered as stagnating (being at equilibrium), or devolving. Is this a veridical understanding of what happens in such systems?

To our accepted methods of observation, definition and measurement of parameters, and evaluation of observations, a system may be deemed devolving, loosing complexity and succumbing to the forces of disorder. The laws of thermodynamics easily convince us that indeed this is what is happening when experimentally observed in a closed system. By extrapolation, it is assumed that entropy keeps gaining the upper hand across the sum total of all systems, and that the universe is damned to the ultimate state of near absolute zero temperature. To finally become homogenous throughout, immobile, still and utterly spent.

It needs to be remembered that contrary to the models of thermodynamics most systems are not closed. Systems interact with one another. But to see these interactions purely in terms of energy exchange - where the term 'energy' is here used in its classical physics sense - would be limiting and hence detrimental to appreciating the full scope of the changes that take place in systems over time as they interact. Interaction is not understood as a process of reciprocity alone, such as a warmer

body loosing heat to a colder body. Rather, interaction is understood as the default operational mode of all that exists. Since space and time can never be entirely void of some form of electromagnetic medium, the sole parameter of a system existing satisfies the proposition that interaction must by default always happen .

Scientific consensus holds that energy can neither be created nor destroyed - only its form can change from one to another. This would suggest that the net energy status of the universe is static – it neither grows nor diminishes. Should information be included as a form of energy? Bearing in mind that 'we have no knowledge of what energy *is*' [1], there is no need to become unnecessarily hindered by rigid definitions. So just like with the concept of energy, what is important in the context of the present hypothesis is that information is 'something' that 'exists'. Information is here understood as the sum total of what a system is. Information includes not only a system's physical, chemical and electromagnetic status, but also its spacial characteristics, such as its geometry and the position it occupies in space in relation to other systems. This also implies and means that if the spacial configuration of surrounding systems change but the spacial and energy status of the system in question remains unaltered (i.e. it has not moved) then nonetheless the information status of this given system still increases. It does so purely because its surrounding environmental spacial configuration, of which it is a part, has undergone change.

Critically important to this presentation is that a system's information status also includes a record of the history of the system. This 'record' is not necessarily understood as the sum total of the physical, chemical, electromagnetic and spacial changes the system has undergone over time, but rather some form of informational mark of these changes on the system. At the current stage of this hypothesis development, photons are considered the primary and fundamental carriers and storers of information [2] at all system levels throughout the universe.

Anything a photon comes in contact with alters its informational content. The photon becomes imprinted with information which pertains to and reflects the parameters and characteristics of the system contacted. Information of aspects of the various attributes of the contacted system 'rub off' onto the photon, are stored, and transported on to the photon's next point of contact. Here, depending on informational interface compatibility, more information can be acquired as well as elements of the already stored information passed onto the contacted system. The implication is that, for example, light can gather, transport and pass on information as it bounces off and passes through physical and biological systems.

New information can be and is created but existing information can never be altogether annihilated. The result is a steady increase in the net informational content of the cosmos. But it is critical not to understand the informational content of a system as its 'memory'. A system's informational content is considered to be a type of energy imprint, or a 'life-experience' signature, rather than a historical record of all the changes a system has undergone in the course of its existence. The simplistic understanding is that photons are the metaphorical paper and the information the print, together documenting a system's evolution. One of the implications of such a scenario is that information generated by the evolving biosphere on a planet such as Earth travels on beams of light essentially

throughout the universe. Another implication is that the life experiences of individual organisms are an informational asset continually fed into or added to the grand informational asset of the universe at large.

While the possibility exists that the universe is indeed headed into the oblivion of thermodynamic maximal entropy, it is nonetheless continually involved in building up its informational content. A single beam of photons touching and reflecting off an object, or passing through it, over the time span of one second carries away a string of information about the object of approximately the length equivalent to the distance between the earth and the moon. In a thermodynamically spent universe at or close to zero degrees Kelvin photons too are frozen [3]. But can they retain their informational content? If so, such universe would appear to be perfectly still and yet pregnant with incommensurable amounts of information in storage.

This, however, is not the favoured scenario in the present hypothesis. Rather, the continuous quantitative and qualitative growth in the universe's informational content is seen as including a feedback loop which allows the process of universal evolution to continue endlessly. In such a scenario, the feedback mechanisms that operate in the universe keep on forever building and refining its complexities and levels of organisation.

References

[1] Feynman, R., Leighton, R., and Sands, M. (1963, 2006, 2010). Conservation of energy. In R. Feynman, R. Leighton, and M. Sands, *The Feynman lectures on physics* (Vol. 1, Chapter 4-1). California Institute of Technology. Retrieved from http://www.feynmanlectures.caltech.edu/I_04.html

[2] *Single photons for optical information transfer.* (2011). Public release 27 October 2011. University of Alberta. Retrieved from http://www.eurekalert.org/pub_releases/2011-10/uoa-spf102711.php

[3] Cromie, W. J. (1999). *Physicists slow speed of light*. The Harvard University Gazette, February 18, 1999. Harvard Gazette archives. Retrieved from http://news.harvard.edu/gazette/1999/02.18/light.html