Review of: "Infodynamics, Information Entropy and the Second Law of Thermodynamics"

Gerardo L. Febres[1]

1 Universidad Simón Bolivar

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This is an old discussion nicely organized and presented by Professor Jaffe. The exposition goes deeply into the theme's origin and may become, as it certainly will for me, a reference for the discussion. However, interpreting entropy leads to differences in the meaning and the relationship of these two entropies.

In my interpretation, entropy is not a substance, energy, or entity that can be contained in a limited space or container. If entropy is regarded as a property, then it would be an intensive property, not an extensive one. Anyway, it does not seem convenient to see entropy as a property. More than a property, entropy is a model describing a distribution of an aleatory variable; a property of a probability distribution, if you will, but not a property directly linked to a physical entity. For a string of symbols, we can think of entropy as a term referring to the amount of *something* (not wanting to use the word information yet) extracted from the patterns somebody found in the string of symbols. The more significant the amount of *something*, the more meanings we can associate with it. We name this amount as information. Therefore, the quantity obtained by computing the entropy of the variable's distribution is what we call information, and [bits] are the units used to give physical meaning.

In the case of thermodynamic entropy, the computation consists of assessing the distribution of heat within the space of a system. The result can be interpreted as an index of the practical (or useful) work that can be converted from the initial system heat distribution. In this context, the work considered practical (or useful) is arbitrary. For instance, vortices are commonly regarded as useless in aerodynamics, and designers try to avoid them. Whereas when designing a flow sand filter, vortices are sometimes the physical principle used to achieve the purpose of the apparatus. Therefore, thermodynamic entropy measures the 'distance' that separates the process trajectory from a reversible process trajectory where all available differential energy converts into useful work. However, this distance, which we call here entropy, is not energy: the physical units for thermodynamic entropy are [Energy/Temperature].

Finally, information and thermodynamics entropy both refer to a measure of how much information can be extracted from the patterns encountered in a long sequence of symbols, or the existing patterns in the way pockets of energy are arranged in the space of a system. In other words, information and thermodynamics entropy are models to characterize distributions of symbol strings and heat or energy. These math models share similar mathematical forms; it may be why von Neumann suggested the name entropy to Shannon when they talked about a good name to call the quantity Sum(p_i . log 1/p_i).