Review of: "Thermodynamics, Infodynamics and Emergence"

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First of all, the authors and I would probably agree on 90+ pct of the statements here, so I will concentrate on commenting on major issues that I have stumbled over - and are wondering about.

Basically, I think the efforts to combine energy and information is necessary for the whole work efforts in the area to proceed - so no problems with that.

Yet I am having doubts about the actual scope of the paper - should be state more clearly, especially how it relates to the title. Is the aim to merge the three concepts?

I will proceed - following the sequence of version2 (I believe) since I just received this before the weekend

Majors

Secondly, The title is slightly misleading as the manuscript do not go into details with neither infodynamics (I think Salthe plays a big part in this) nor emergence, which have received several thorough treatmens over the last decades (e.g. Emmeche et al. Journal for General Philosophy of Science 28: 83–119, 1997.) This means that the emergence/emergentism used in the paper does not well relate to primary/secondary emergence, strong/weak emergence, upward/downward causation which would have been interesting. (the novelty is adressed page 18 but according to the just mentioned paper is not enough to address emergence, and then if an emergent property repeats is it not emergent any longer?)

Thirdly, several places on get the impression that energy and entropy has the same units - initially in verbal formulations (eg. p4 Entropy is the energy that can not be used to produce work, right word for this would be Anergy) - but also in equation such as the one given on page 11 and several other places that follows this. This is problematic and in particular gets difficult when the concept of useful information is introduced. As the author also remarks we have no idea of and need to determine some exchange rates in this context. Even Boltzmann made statements about the equivalence of energy and information, but to my knowledge never came to any clear mathematical formulations of this relationship. Thus not surprisingly I do not agree with the first passage in the conclusions made on p10.

Minors

In the presentation of energy - potential energy is left out of mechanical energy (p3)

Several references made to order and disorder - statement which represent a minefield - and according to most physicist that I know - there is no proper definition of this (e.g.p4)

Several places also useful energy - and free energy - and work is used as synonyms. Exergy is another word for this - and to my opinion offers the framework to solve many of the debates, especially together with the concept of thermodynamic information (from Evans or Brillouin, do not remember).

Thermodynamic information is not mentioned on p7

Recently the concept of (bio-)semiosis has been introduced - together with code-duality, where at least the binary forms can be translated into “information” sensu lato

Useful information needs a proper definition (eg. p4)

How much does it take to be complex and show emergence? Even a simple system like Benard cells demonstrate patterns which must be considered emergent, but the system is not really complex, - but complex enough. So, a good definiton of emergent system is needed - although the concept of emergence is explained 18. The simple molecular system H2O is demostrating emergence but extremely simple as compared to life, although the emergent property is vital.

Edge of chaos probably starts around Kaufmann (1996) - but even earlier Packard and others uttered around this - many publications for the Santa Fe Institute around this.

Which is the FFE law referred at the sixth last line? Not demonstrated to be wrong - but has it been confirmed. Please elaborate!