Review of: "Thermodynamics, Infodynamics and Emergence"

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(1) This article attempts to link together the notions of free energy, information and emergence. I think it's too ambitious, because it tries to embrace all fields, from physics and chemistry to the human sciences and economics. It would be better to focus on biology, for example, and on the transition between the physical, the chemical and the biological.

(2) He then wanted to introduce the notion of useful information, distinguishing between useful information and information that is entropic in some way. Useful information is that which increases the free energy of a system. Information is needed, for example, to produce an endergonic reaction that will allow an ADP molecule to recharge into ATP, or an NAD molecule to recharge into NADH. To be honest, I'm not sure that the concept of information is actually useful for thinking about such a process. Why not use the concept of constraint instead? What the author evokes in this example does not allow us to understand the dynamics through which useful information can be acquired by a system.

If instead we talk, as Stuart Kauffman does, of a work/constraint cycle, things become clearer. We are dealing here with a system which, under certain constraints, produces work which is capable of bringing new constraints to the fore. A system of this kind is capable of doing this insofar as, while it is physically and chemically open, it can organise itself biologically. It can loop back on itself, not just as a set of states, but as a set of functions or constraints. The concept of information removes the key idea: such systems refer to themselves. They organise themselves. It seems to me that the major challenge is to understand how they refer to themselves, and what type of organisation characterises them.

(3) Finally, I find the connection between the notions of useful information, dimension and emergence extremely obscure in this article. Sometimes you get the impression that emergence is nothing more than the banal idea of a whole that cannot be reduced to the sum of its parts, without any further clarification. At other times, emergence is the result of interactions between the parts in a whole. At still other times, emergence is the result of interaction between different dimensions of reality, or "between different levels of complexity". The author uses the term "structural information" to describe this multidimensional information. We really need to clarify all this.

To begin with, the concept of organisation can still help. A system that organises itself is a system whose structure is also the result of its operations. In other words, what it does is not a simple property of what it is. In other words, what it does is always potentially more than what it is. So we can understand that a new constraint emerges in such a system, as a result of its activity, and not as a consequence of its complexity.

I also think that there are interactions between levels in a biological system, and that this is even a central concept. We

need to show why this is so. The difference between interactions of levels and interactions of elements should be made clearer. And we need to show what specific meaning this can have in biology, and once again how this distinguishes a biological system from a physical system like a crystal or a flame.