Review of: "Thermodynamics, Infodynamics and Emergence"

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Potential competing interests: No potential competing interests to declare.

This is a very interesting paper and addresses important aspects of thermodynamics, information and order. I have a couple of constructive observations. Firstly, you need to cite a lot more literature. There is a vast amount of literature covering this area. As a starter, have a read of Skene (Skene, K.R., 2020. In pursuit of the framework behind the biosphere: S-curves, self-assembly and the genetic entropy paradox. *Biosystems*, *190*, p.104101.) which will highlight some of this literature. The main aspect that I would highlight is the importance of stressing that the driver in a complex system is the second law of thermodynamics, where increasing disorder rather than order is the main function of information, and increasing complexity merely generates greater disorder. Thus complexity is the outcome of the second law, because complexity requires entropy production, provided free energy is available. The Maximum Entropy Production Principle is another central are that should be raised at the outset, governing as it does, the essential relationship between thermodynamics and systems theory. There is a large body of literature on this, but you could start by considering some of the following:

Annila, A.; Salthe, S. 2010. Physical foundations of evolutionary theory. J. Non-Equilib. Thermodyn. 2010, 35, 301–321.

Boltzmann, L. The second law of thermodynamics. In Theoretical Physics and Philosophical Problems: Selected Writings; McGinness, B., Ed.; D. Reidel: New York, NY, USA, 1974; pp. 13–32.

Farnsworth, K.D.; Niklas, K.J. Theories of optimization, form and function in branching architecture in plants. Funct. Ecol. 1995, 9, 355–363

Johnson, L. The thermodynamic origin of ecosystems. Can. J. Fish. Aquat. Sci. 1981, 38, 571– 590.

Kleidon, A., Lorenz, R.D. Entropy production by earth system processes. In Non-Equilibrium Thermodynamics and the Production of Entropy: Life, Earth, and Beyond; Kleidon, A., Lorenz, R.D., Eds.; Springer: Berlin, Germany, 2004; pp. 1–20.

Martyushev, L.M.; Seleznev, V.D. Maximum entropy production principle in physics, chemistry and biology. Phys. Rep. 2006, 426, 1–45.

Skene, K.R., 2013. The energetics of ecological succession: A logistic model of entropic output. *Ecological modelling*, *250*, pp.287-293.

Skene, K.R., 2015. Life's a gas: A thermodynamic theory of biological evolution. *Entropy*, *17*(8), pp.5522-5548.

Skene, K.R., 2017. Thermodynamics, ecology and evolutionary biology: A bridge over troubled water or common ground?. *Acta Oecologica*, *85*, pp.116-125.

Swenson, R. Emergent attractors and the law of maximum entropy production: foundations to a theory of general evolution. Syst. Res. 1989, 6, 187–197.

Toussaint, O.; Schneider, E.D. The thermodynamics and evolution of complexity in biological systems. Comp. Biochem. Physiol. 1998, 120, 3–9

Wiley, E.O.; Brooks, D.R. Victims of history—a nonequilibrium approach to evolution. Syst. Biol. 1982, 31, 1–24.