Purposive physics

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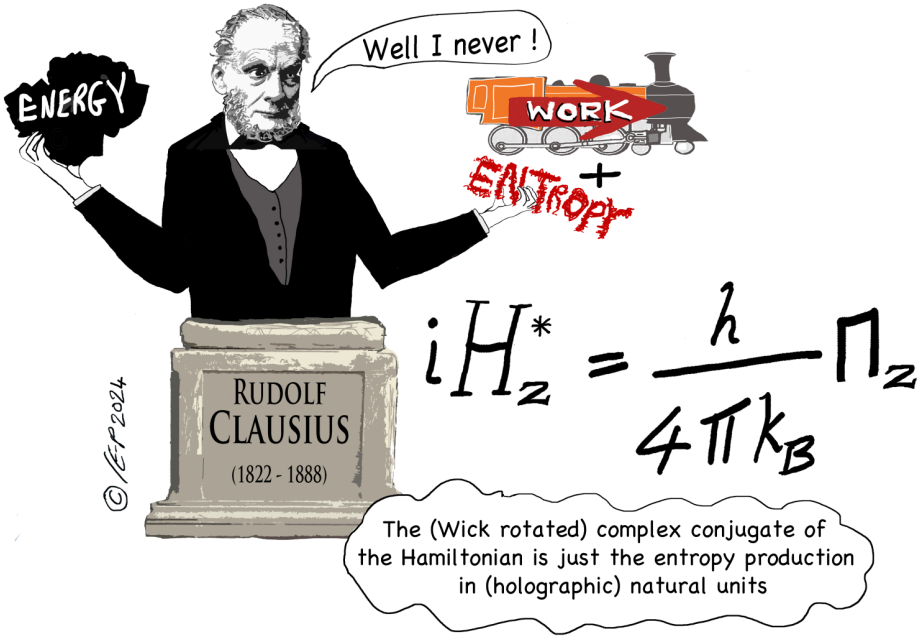

Figure 1: This is the Graphical Abstract for 'Relating a System's Hamiltonian to Its Entropy Production Using a Complex Time Approach' (Parker & Jeynes, April 2023)

"The Universe doesn't care about us. It can't since it has no purpose!" This is what we are told. But is it true? How would we know either way?

Concentrating on the physics (never mind the philosophy), the idea of *aimlessness* arises because the 'fundamental equations' (of Quantum Mechanics **QM**, and General Relativity **GR**) are reversible in time. Obviously, you can't have purpose if you can't distinguish the future from the past.

On the other hand, we know that time only goes forward, it never goes back! Experience seems to contradict 'physics'. Of course, common sense can be deeply misleading; however, last year, we discovered that our intuition can actually reveal good physics as well. It turns out (see Figure 1) that if you do the thermodynamics properly, you get the result that *Energy* and *Entropy Production* are two sides of the same coin – they are the same sort of thing!

Note that whenever you do anything useful as you go about your life, you have to produce entropy (which you can't get back). This is the Second Law of Thermodynamics: time never goes backwards, and entropy always increases. The key insight required for this is the understanding that time is a complex quantity. That is to say, time plays itself out along a two-dimensional temporal plane with real and imaginary axes. Ivo Dinov already introduced a 5D 'spacekime' as a highly useful computational tool – but now we see that it also represents reality! The maths of complex analysis might be a bit hard, but just like thermodynamics, it was also all developed and already familiar in the 19th century! It's not particularly new, and it allows us to integrate the phenomena of thermodynamically reversible and irreversible (dissipative) processes into a single coherent theory and thereby clear up some puzzling scientific paradoxes that have been haunting us for nigh on 150 years.

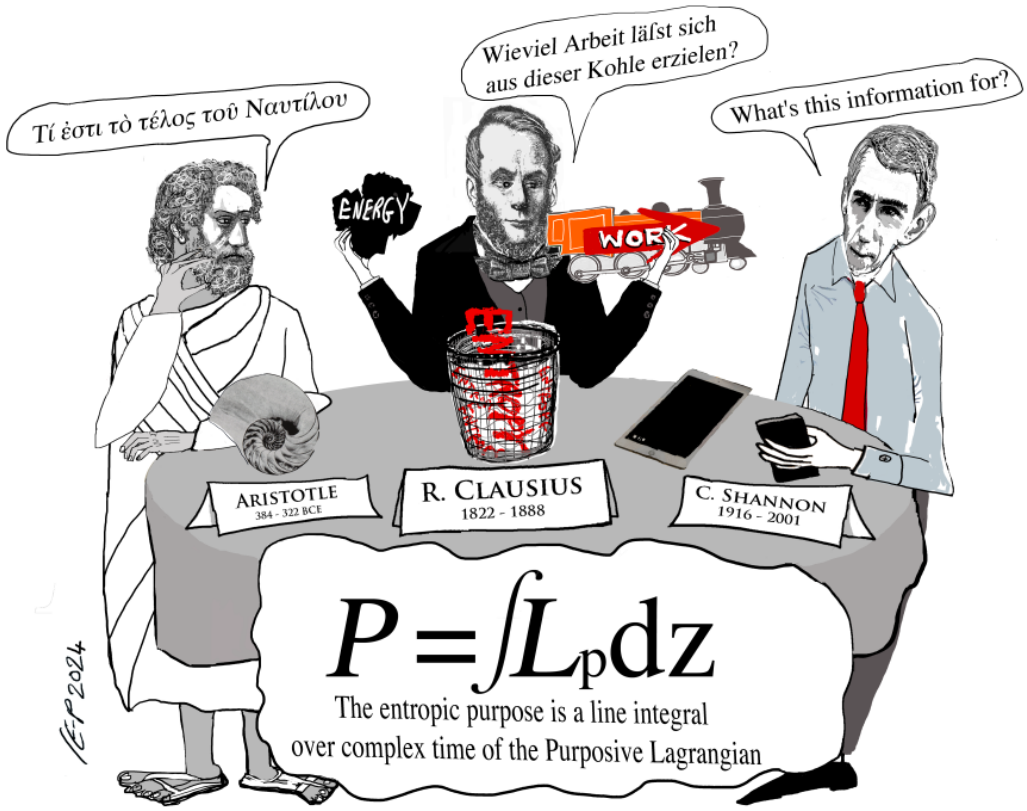

Figure 2: This is the Graphical Abstract for 'A Metric for the Entropic Purpose of a System' (preprint, Parker, Jeynes, Walker November 2024);
Aristotle: "What's Nautilus' purpose?" Clausius: "How much work's in this coal?"

The 20th century saw the realisation that digital information is another important aspect of thermodynamics, with Claude Shannon providing the scientific understanding. In particular, he was able to provide an impersonal definition for what we call ‘Shannon’ information (which doesn’t rely on what you or I might personally know) and which has underpinned the remarkable computing and internet revolutions that have transformed modern life. But, just as Shannon was able to define an impersonal measure of information using entropy, so now we have also found the mathematical means to define an impersonal ‘entropic purpose’ (see Figure 2). Aristotle’s old idea that things must have purposes just might have some truth after all. Both the maths and the physics are quite clear: (entropic) purpose really is built into the physical Universe. It is not an illusion! It seems that the equations of QM and GR are only (amazingly good) approximations to a more interesting (‘complex’) reality.

Figure 2 shows the result – there is a definite way to calculate the ‘*entropic purpose.*’ This is a big surprise, since before the scientific revolution could make any progress in the 17th century, we first had to overturn Aristotelian *teleology*! Now that physics has sufficiently developed, it’s ‘safe’ enough to return to earlier concepts and exploit the kernels of truth that resided there. In particular, we have now proved that information is *created* by a system if it exhibits ‘entropic purpose’. The Universe really is teeming with purpose, trying to burst out and manifest itself as information. Any attempt to obtain a fundamental physical understanding of living things has to provide a systematic description of treating the choices they make.

In Figure 2, Aristotle is looking at a Nautilus shell (from the Indian Ocean: this probably came to him from his contacts in Alexander the Great’s army). Nautilus embodies the logarithmic spiral, which is central to the maths we use and ubiquitous in the natural world. Clausius coined the term ‘entropy’ and asked fundamental questions about the thermodynamic efficiency of systems, while Shannon showed how to use the methods of entropy to quantify information and design high-efficiency communications systems. Now, we can start answering the implicit question: what’s the purpose?

Living things (especially us!) have purposes. We’ve shown that it’s possible to define an impersonal sort of purpose (‘entropic purpose’) in properly physical terms, although obviously, our human purposes admit no such pared-down definition. However, we have opened up a small doorway into a new physical way of understanding life and shown how to analyse the way it creates information and exhibits purpose.

We know that it’s not easy to say exactly what all this means, but with recent developments in AI and quantum biology, it has become urgent to have some scientific way of talking about purposes and the ways that life manifests itself.

Further reading

M.C.Parker, C.Jeynes, S.D.Walker, A Metric
for the Entropic Purpose of a System; preprint:
https://www.preprints.org/manuscript/202411.2050/v1

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