



ELSEVIER

Contents lists available at ScienceDirect

# Studies in History and Philosophy of Modern Physics

journal homepage: [www.elsevier.com/locate/shpsb](http://www.elsevier.com/locate/shpsb)

Discussion

## Author's Reply to Landauer Defended

John D. Norton

Department of History and Philosophy of Science, Center for Philosophy of Science, University of Pittsburgh, Pittsburgh, PA 15260, USA



In Norton (2011), I argued that all efforts to demonstrate Landauer's Principle have failed. The proof system used by Ladyman, Presnell, Anthony, and Groisman (2007) and Ladyman, Presnell, and Short (2008) admit processes, such as is above called  $P_N$ , that violate the second law of thermodynamics. Ladyman and Robertson (this issue) argue that  $P_N$  is not what they call a "controlled operation". Whether it is or not is beside the point. Controlled operations are a proper subset of physically possible processes and  $P_N$  is a physical process, produced by combining licit operations in their system, as discussed in Norton (2011, Section 6.2) and in related remarks on "anthropomorphizing" on p. 198.

This last objection adopts the framework of Ladyman et al. solely for purposes of reductio, for the framework is untenable in its entirety. That is shown in Norton (2011, Section 7.4; in press). There, a short, but strong no go result shows that all efforts to demonstrate Landauer's Principle must fail in so far as they suppose that thermodynamically reversible processes can be implemented in molecular scale devices, as

do Ladyman et al. Such processes are fatally disrupted by fluctuations that can only be overcome by creating thermodynamic entropy well in excess of the  $k \ln 2$  tracked by Landauer's Principle. I have been unable to discern how Ladyman and Robertson's remarks on fluctuations reverse this no go result.

### References

- Ladyman, J., Presnell, S., & Short, A. (2008). The use of the information-theoretic entropy in thermodynamics. *Studies in History and Philosophy of Modern Physics*, 39, 315–324.
- Ladyman, J., Presnell, S., Short, A. J., & Groisman, B. (2007). The connection between logical and thermodynamic irreversibility. *Studies in the History and Philosophy of Modern Physics*, 38, 58–79.
- Norton, J. D., The end of the thermodynamics of computation: a no go result. *Philosophy of Science*, in press.
- Norton, J. D. (2011). "Waiting for Landauer". *Studies in History and Philosophy of Modern Physics*, 42, 184–198.

E-mail address: [jdnorton@pitt.edu](mailto:jdnorton@pitt.edu)

URL: <http://www.pitt.edu/~jdnorton>