Abstractions and implementations: a computer science perspective on emergence, causality, and multi-level autonomy

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**Abstract.** Fundamentalto Computer Science is the distinction between abstractions and implementations. When that distinction is applied to various philosophical questions it yields the following conclusions.

* *Emergence*. It isn’t as mysterious as it’s made out to be; the possibility of strong emergence is not a threat to science.
* *Causality and interactions*. Physical interaction among higher-level entities is illusory. Abstract interactions are the source of emergence, new domains of knowledge, and complex systems.
* *The relationship between physics and the special sciences*. The new domains of knowledge derived from abstract interactions are the basis of the autonomy of the special sciences.
* *Downward causation*. It’s a zombie idea that should have a stake put through its heart and be replaced by downward entailment.