

On the Inherent Incompleteness of Scientific Theories

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Abstract

We examine the question of whether scientific theories can ever be complete. For two closely related reasons, we will argue that they cannot. The first reason is the inability to determine what are "valid empirical observations", a result that is based on a self-reference Gödel/Tarski-like proof. The second reason is the existence of "meta-empirical" evidence of the inherent incompleteness of observations. These reasons, along with theoretical incompleteness, are intimately connected to the notion of belief and to theses within the philosophy of science: the Quine-Duhem (and underdetermination) thesis and the observational/theoretical distinction failure. Some puzzling aspects of the philosophical theses will become clearer in light of these connections. Other results that follow are: no absolute measure of the informational content of empirical data, no absolute measure of the entropy of physical systems, and no complete computer simulation of the natural world are possible. The connections with the mathematical theorems of Gödel and Tarski reveal the existence of other connections between scientific and mathematical incompleteness: computational irreducibility, complexity, infinity, arbitrariness and self-reference. Finally, suggestions will be offered of where a more rigorous (or formal) "proof" of scientific incompleteness can be found.

Keywords: theory complete gödel tarski breuer self-reference incomplete belief arbitrary arbitrariness quine duhem underdetermination observational theoretical distinction god entropy complexity infinity mathematical valid empirical meta-empirical data model pattern observation precision accuracy computational irreducibility algorithmic information randomness TOE grand unified planck limit faith doubt theory-ladenness science scientific sensory senses thought cognitive cognition top-down perception perceptual plasticity language understanding explanation relational quantum physics autopoietic autopoiesis maturana valera piaget embodied mind brain hermeneutic analytic synthetic holism holistic convergence indeterminacy translation deconstruction meta-theory metatheory meta-theorem merleau-ponty heidegger gadamer wittgenstein derrida wolfram chaitin

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