

Can thought experiments be resolved by experiment? The case of "Aristotle's Wheel"

Abstract

"Aristotle's Wheel" was an imagined scenario described in the Aristotelian treatise *Mechanical Problems* in which a wheel is imagined to be rolling in a rut in such a way that its hub is also in contact with the ground. After several rotations, the wheel and its hub must travel different distances! I contend that this scenario has a good claim to be a thought experiment, and indeed one of the very earliest thought experiments: it is an imagined scenario, with accompanying diagram, one that leads to paradox, so that it is apparently physically impossible; and it is designed to promote reflection on the principles involved. Can this thought experiment be resolved by experiment? Historically, two very different responses have been given to this question. Galileo insisted that it was a conceptual problem about the infinite that could be resolved by regarding the continuum as composed from an infinity of unquantifiable points separated by unquantifiable voids, thus allowing the expansion or contraction necessary for the scenario of Aristotle's wheel to be able to occur. Similarly, modern Cantorians have insisted that the paradox is generated by a confusion of the equality of the (infinite) numbers of points on the circumferences of the wheel and hub with an equality of their measures. And yet the correct resolution of this paradox is quite different: the hub must slip and slide, as can be verified experimentally. There are similar puzzles concerning the relationship of thought experiment to real experiment in the case of Galileo's famous thought experiment with falling bodies, and in that of the Bell-EPR thought experiment and its resolution in the experiments of Aspect and others. These case studies are intriguing for what they tell us not only about the relation between thought experiment and actual experiment, but also about the difficulty of deciding how to identify a given thought experiment in the first place.