# Classical Mechanics Is Lagrangian; It Is Not Hamiltonian; The Semantics of Physical Theory Is Not Semantical

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## Abstract

One can (for the most part) formulate a model of a classical system in either the Lagrangian or the Hamiltonian framework. Though it is often thought that those two formulations are equivalent in all important ways, this is not true: the underlying geometrical structures one uses to formulate each theory are not isomorphic. This raises the question whether one of the two is a more natural framework for the representation of classical systems. In the event, the answer is yes: I state and prove two technical results, inspired by simple physical arguments about the generic properties of classical systems, to the effect that, in a precise sense, classical systems evince exactly the geometric structure Lagrangian mechanics provides for the representation of systems, and none that Hamiltonian mechanics does. The argument not only clarifies the conceptual structure of the two systems of mechanics, their relations to each other, and their respective mechanisms for representing physical systems. It also provides a decisive counter-example to the semantical view of physical theories, and one, moreover, that shows its crucial deficiency: a theory must be, or at least be founded on, more than its collection of models (in the sense of Tarski), for a complete semantics requires that one take account of global structures defined by relations among the individual models. The example also shows why naively structural accounts of theory cannot work: simple isomorphism of theoretical and empirical structures is not rich enough a relation to ground a semantics.

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