Towards a Taxonomy of ‘Experiments’ for Studying Epistemic Questions about Methodologies of Climatic Change

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Introduction

This poster aims to develop, clarify and apply a taxonomy of scientific experimentation, represented according to different features of each method of scientific inquiry. While there is ongoing discussion among philosophers about epistemic issues related to this taxonomy, debates are sometimes unnecessarily obscured regarding which feature or type of ‘experiments’ under consideration.

Many philosophers mark off different classes of experimentation according to especially important epistemic features, such as the need for a natural, or reductive attempt to retrieve related epistemological questions. Accordingly, marking off different classes of experimentation according to potentially important epistemic features, such as these natural features, may require attempts to retrieve related epistemological questions. What follows is a set of methods of scientific inquiry.

Key Terms

There is significant diversity of meaning in the range of key terms in the epistemological literature on experiment and computer simulation modelling. Much of the literature is typical of 1995 (Rahwan 2009), which will be the case in this paper.

Target system: The system about which one aims to ascertain knowledge. The system about which one aims to ascertain knowledge.

Object system: The system upon which one can simulate some aspects of it.

Kinds of Experiments

(A) Traditional Experiment (TE): The object system is a concrete object system under controlled, repeatable conditions, such that independent variables can be isolated. In some cases, the class of inquiry is refined to “auto- system” or “potentiological” science (Gillard 1995, Gilard 2002).

In some TEs, the object system is composed of the same material as the target system, thereby meeting the materiality condition. In each such case, the object system is regarded as a ‘replica’ of the target system. One will call these instances of ‘traditional experiment without materiality’ (TEm).

E.g., The Fultz (1949) dishpan experiment simulating atmospheric phenomena using an object system that is made of different material than its target system (Wear 2010).

(B) Natural Experiment (NE): An observational study of a target system in which conditions of experimental systems are produced by ‘nature’ rather than by controlled lab manipulations.

E.g., When Mount Pinatubo erupted in 1991, scientists could observe the climatic consequences of injecting a significant amount of aerosols (including about 15 million tons of sulfur) into the atmosphere.

(C) Field Experiment (FE): Some aspect of the object system is manipulated in order to determine its effect on the theoretical implications of the manipulated variable. In those cases, the object systems of a simulation or experiment are made of the same physical material.

Concrete simulation or experiment: A simulation or experiment in which the object system is abstract (Boxes 3-5).

Abstract simulation or experiment: A simulation or experiment in which the object system is abstract (Boxes 8).

Materiality (same-stuff) condition: The target and object systems of a simulation or experiment are made of the same physical material.

Concreteness condition: The target and object systems of a simulation or experiment are made of different material.

Stages of model-empirical interactions

Model runs

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Computer simulation models involve reasoning about aspects of target systems that have been observed. Nonetheless, a computer simulation model is grounded in a pre-existing model that captures an empirical inferential schema to simulate the target system. Models evolve over time and may be updated at different levels of sophistication in a process known as model improvement. Models can be improved at different levels of sophistication in a process known as model improvement.

Model revision, model evaluation and model confidence

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