

Buitenpromovendi-middag, PhD-afternoon
New Mechanists in Philosophy of Science
In Search of Mechanisms
January 25, 2014

M. Haghghi Fard (Sasan)
PhD Candidate
Leiden University
Supervisor: Dr. James McAllister

New Challenges to Philosophy of Science

- For philosophy of science, a central question is what counts as a scientific explanation.
- New mechanists claim and argue that the best conception of scientific explanation is the mechanistic one.
- MDC, 2000. Bechtel, 2005. Craver, 2007.

In Search of Mechanisms 1

- I claim that thinking in terms of mechanisms provides a new framework for addressing many traditional philosophical issues such as “causality, laws, explanation, reduction and scientific change” (MDC, 2000). I focus on explanation in neuroscience.
- I will show what is a good mechanistic explanation and what is its usefulness (implications) for philosophy of science and even for daily life.

In Search of Mechanisms 2

- The mechanistic view has been extended to disciplines ranging from computer science through chemistry to sociology (see e.g. (Piccinini 2007), (Thagard 2003), (Mayntz 2004); and to philosophical issues including reductionism, feminism, objectivity, mind-body problem, scientific explanations (e.g. Delehanty 2005), (Fehr 2004), (Thagard 2008), (Craver, 2007, 2008, 2012, 2013).

Machines versus Mechanisms 1

- Mechanisms are often quite unlike machines.
- Mechanisms are entities and activities organized such that they are productive of regular changes from start or set-up to finish or termination conditions. (Craver, Darden 2013).
- A machine is a contrivance, with preexisting, organized, and interconnected parts.

Machines versus Mechanisms 2

- The mechanical clock, the water pump, the internal combustion engine, and the computer would be the paradigm examples.
- The blueprint of the typical mechanism is messier than the blueprint for even complicated machines.
- In addition, mechanisms are characteristically active; they are how things work, when they work. Machines exist in active and inactive states.

Machines versus Mechanisms 3

- Machines exist in an active and inactive states. A stopped clock is a machine but not a mechanism. It is an organized assemblage of parts without any activities. Mechanisms (e.g. biological) do things. They move things. They change things. They synthesize things. They transmit things.

Just guess; which one of them is J.F.Kennedy?



The Terms 'Mechanism' and 'Machine' are Not Synonymous

- Finally, and perhaps most to the point, one and the same machine might be composed of a number of wholly distinct mechanisms. The car has a windshield wiper mechanism and an engine. It has also a radio. The windshield wiper and an engine are not both part of a single mechanism.

Components and Features of Mechanisms

- Entities and Activities
- Setup, Start, and Finish Conditions
- Productive continuity
- Regularity
- Organization
- Spatial
- Temporal
- Active
- Levels of Mechanisms
- Topping –off , Bottoming-out and Mechanistic Context

A Close Look at Mechanisms 1

- Entities and Activities:
- Mechanism are composed of both entities and activities.
- Activities are the producers of change
- An enzyme (entity) phosphorylates (activity) a protein (entity). A neuron (entity) releases (activity) a neurotransmitter (entity).
- In description of mechanisms, nouns (channel, terminal, enzyme) usually refer to entities.
- Active verbs (bond, release, phosphorylate) refer to activities.

A Close Look at Mechanisms 2

An ontic conception

- Mechanisms (good explanations) in neuroscience show how phenomena are situated within the causal structure of the world(salmon, 1984. Craver, 2007).
- Dimensions of mechanism schemas:
- Completeness: sketch to schema
- Detail: abstract to specific
- Support: how-possibly to how-actually
- Scope: narrow to wide

Two Goals of Neuroscience

- One goal is explanation: neuroscientists want to know how the brain develops from infancy to adulthood, how the visual system gives rise to the perception of color, and how the vestibular system helps to keep us upright.
- Also in many textbook introductions we find claims that neuroscientists are on the verge of explaining the mysteries of consciousness, the illusion of free will, the nature of the self.
- If neuroscience succeeds in these explanatory goals, it will revise our self-conception as radically as Copernicus' decentering of the earth and Darwin's humbling vision of our origins.

The Second Goal of Neuroscience

- To control the brain and the central nervous system. (Craver, 2007).
- Neuroscience is driven in large part by the desire to diagnose and treat diseases, to repair brain damage, to enhance brain function, and to prevent the brain's decay.

The Implications of Mechanistic Explanations

- Both goals of neuroscience are complimentary
- Explaining the brain is one way to figure out how to manipulate it, and manipulating the brain is one way to discover and test explanations.

Three Main Features of Explanations

- Explanations describe mechanisms
- Explanations span multiple levels
- Explanations integrate findings from multiple fields

The Ontic Conception of Explanation

- Craver objects to explanations that include non-ontic entities, such as diagrams and equations, because they can not produce any worldly phenomenon.
- Some known phenomena have unknown explanations. Here explanation is being used very much synonymously with 'cause'; known phenomena have unknown causes.
- Craver is arguing for the importance of ontic constraints in recognizing, finding, and possibly even using good explanations.

Ontic constraints for a Good Explanation

- (E1) mere temporal sequences are not explanatory
- (E2) causes explain effects and not vice versa
- (E3) causally independent effects of common causes do not explain one another
- (E4) causally irrelevant phenomena are not explanatory
- (E5) causes need not make effects probable to explain them

The Epistemic Conception of Explanation

- Explanation is fundamentally an epistemic activity performed by scientists (Bechtel, 2008).
- Bechtel holds that explanation is deeply concerned with understanding , and is essentially a human cognitive activity.
- For Bechtel mechanistic explanations are texts, or descriptions and so on, that aim to increase knowledge about mechanisms.

Conclusions

Integrating the Ontic and Epistemic

- Good mechanistic explanations must satisfy both ontic and epistemic constraints.
- Craver argues for ontic constraints , but he does not offer arguments against epistemic constraints, even some of his work seems to commit him to accepting them alongside ontic constraints. Likewise is true about Bechtel.

Thank you
and

Thanks to my supervisor
Dr. James McAllister