CAUSATION
Background Material For A Mini-workshop On Causation
Tuesday 8th June, Learning Centre Room UG 10 2pm
University of Birmingham

Details of Workshop

(INCOMPLETE DRAFT: Liable to change -- Contributions welcome!)

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This document is
http://www.cs.bham.ac.uk/research/projects/cogaff/misc/causation-background.html
A partial index of discussion notes is in
http://www.cs.bham.ac.uk/research/projects/cogaff/misc/AREADME.html

Philosophical Theories of Causation
A long and varied history

Online sources include:

- http://plato.stanford.edu/entries/causation-metaphysics/
  The Metaphysics of Causation
  Questions about the metaphysics of causation may be usefully divided into questions about the causal relata, and questions about the causal relation. Questions about the causal relata include the questions of (1.1) whether they are in spacetime (immanence), (1.2) how fine-grained they are (individuation), and (1.3) how many there are (adicity). Questions about the causal relation include the questions of (2.1) how causally related and causally unrelated sequences differ (connection), (2.2) how sequences related as cause to effect differ from those related as effect to cause or as joint effects of a common cause (direction), and (2.3) how if at all sequences involving causes differ from those involving mere background conditions (selection).
  ....
  Philosophers have, of course, disagreed over all of these questions.....

- http://plato.stanford.edu/entries/causation-counterfactual/
  Counterfactual Theories of Causation

- http://plato.stanford.edu/entries/causation-mani/
  Causation and Manipulability

- http://plato.stanford.edu/entries/mental-causation/
  Questions about the existence and nature of mental causation are prominent in contemporary discussions of the mind and human agency. Originally, the problem of mental causation was that of understanding how an immaterial mind, a soul,

could interact with the body. Most philosophers nowadays repudiate souls, but the problem of mental causation has not gone away. Instead, focus has shifted to mental properties. How could mental properties be causally relevant to bodily behavior? How could something mental qua mental cause what it does? ...

NOTE:
Most philosophical discussions of these topics completely ignore what computer systems engineers have discovered and developed in the last half century or so about *Virtual Machine Functionalism* mentioned below.

- http://plato.stanford.edu/entries/content-causal/
  Causal theories of mental content attempt to explain how thoughts can be about things. They attempt to explain how one can think about, for example, dogs. These theories begin with the idea that there are mental representations and that thoughts are meaningful in virtue of a causal connection between a mental representation and some part of the world that is represented. In other words, the point of departure for these theories is that thoughts of dogs are about dogs because dogs cause the mental representations of dogs. .....

  NOTE:
  This is another area where most philosophical discussions completely ignore what has been achieved by engineers in giving machines, especially machines that include sophisticated *virtual machinery* the ability to have, and to use intentional states, for example when attempting to identify faults in complex machinery, or when controlling the behaviour of a complex machine (e.g. landing an airliner, or monitoring flows in oil refineries. (In the UK there was a major research project on transferring responsibility for such tasks from human operators to AI systems, in the 1980s, as part of the Alvey Project.
  http://en.wikipedia.org/wiki/Alvey
  Philosophers (e.g. Elizabeth Anscombe) have distinguished the "direction of fit" of intentional states to what they refer to in belief-like states, and desire-like states. The same distinction between two "directions of fit" are important in many control systems -- that was McCarthy's point. Instead of arguing in a knowledge vacuum about what machines (especially computers) can and cannot do philosophers need to learn about the many intermediate cases and what difference they make, e.g. cases between a homeostatic control system and a plant control system or a future intelligent tutoring system, which will need to refer to mental sates and processes in learners.

- http://plato.stanford.edu/entries/causation-medieval/
  Causation in medieval philosophy
  -- Aristotle's ideas
  -- Theology

- http://plato.stanford.edu/entries/causation-process/
  ...philosophers interested in analysing causal processes have tended to see the chief task to be to distinguish causal processes such as atoms decaying and billiard balls moving across the table from pseudo processes such as moving shadows and spots of light. These philosophers claim to have found, in the notion of a causal process, a key to understanding causation in general.

- http://plato.stanford.edu/entries/content-causal/
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- http://plato.stanford.edu/entries/fictionalism-modal/
  Modal Fictionalism
  Questions about necessity (or what has to be, or what cannot be otherwise) and possibility (or what can be, or what could be otherwise) are questions about modality. Fictionalism is an approach to theoretical matters in a given area which treats the claims in that area as being in some sense analogous to fictional claims: claims we do not literally accept at face value, but which we nevertheless think serve some useful function. However, despite its name, "Modal Fictionalism" in its usual manifestations is not primarily fictionalism about claims of necessity and possibility, but rather a fictionalist approach to claims about possible worlds.

- http://plato.stanford.edu/entries/causation-backwards/
  Backward Causation
  retro-causation

- http://plato.stanford.edu/entries/spacetime-singularities/lightcone.html
  .... the causal structure of spacetime ... specifies which events (that is, which points of space and time) can be connected by trajectories that are slower than light, which events can be connected by trajectories traveling at the speed of light, and which events cannot be connected by anything travelling at or below light speed. Events in the first group are said to be "timelike related," because a physical clock could travel from one event to the other. Events in the second group are "lightlike related" because a light ray can travel from one to the other. Events in the third group are "spacelike related." Given that it is physically impossible (on the standard interpretation of relativity theory) for any causal process to exceed the speed of light, these three possible ways of being connected tell us whether one event is able to influence another.

- http://plato.stanford.edu/entries/computation-physicalsystems/
  In our ordinary discourse, we distinguish between physical systems that perform computations, such as computers and calculators, and physical systems that don’t, such as rocks. Among computing devices, we distinguish between more and less powerful ones. These distinctions affect our behavior: if a device is computationally more powerful than another, we pay more money for it. What grounds these distinctions? What is the principled difference, if there is one, between a rock and a calculator, or between a calculator and a computer? Answering these questions is more difficult than it may seem.
  ...Computation is also central to psychology and neuroscience (and perhaps other areas of biology). According to the computational theory of cognition, cognition is a kind of computation: the behavior of cognitive systems is causally explained by the computations they perform. In order to test a computational

theory of something, we need to know what counts as a computation in a physical system. Once again, the nature of computation lies at the foundation of empirical science.
....
Some authors argue that the physical universe is fundamentally computational. The universe itself is a computing system, and everything in it is a computing system too (or part thereof).

- http://plato.stanford.edu/entries/causation-probabilistic/
  Probabilistic Causation

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probabilistic theories of singular causation
probabilistic theories of general causation
....
(Should include Karl Popper on propensities?)
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- http://plato.stanford.edu/entries/epistemology-bayesian/
  Contrast relations of evidence vs relations of causation.

- http://plato.stanford.edu/entries/causation-process/
  Causal Processes vs "pseudo causal" processes
  E.g. Bertrand Russell on "causal lines"

- http://rsfs.royalsocietypublishing.org/content/2/1.toc
  Royal Society meeting on Top-down causation
  Organized by George F. R. Ellis, Denis Noble and Timothy O'Connor
  February 6, 2012;

- **Other topics:**
  -- Mathematical causation (to be added)

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E.g. adding or removing a bridge in Konigsberg would cause a new
route to become possible, removing the old impossibility.
http://mathforum.org/isaac/problems/bridges1.html
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  -- Social causation

- CLAIM:
  Much philosophical discussion of causation is now out of date, because it ignores causation in sophisticated virtual machinery (not just finite state machines). See Virtual Machine Functionalism

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WORK IN PROGRESS -- TO BE EXPANDED
SUGGESTIONS FOR ONLINE MATERIAL TO BE ADDED WELCOME

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