ABSTRACTS

B2.2 Formal Philosophy of Science and Formal Epistemology

Intervention and Decision

Christopher Hitchcock, Division of Humanities and Social Sciences, California Institute of Technology, Pasadena, USA

In 1994, Christopher Meek and Clark Glymour published a paper in which they argued that the difference between evidential and causal decision theory could be understood in terms of the different operations of conditioning and intervening on a causal graph. I develop their proposal to understand causal decision theory in terms of interventions. I show how this approach can be used to defend causal decision theory against standard counterexamples, such as Newcomb’s problem. More importantly, the interventionist framework helps us to clarify the problem in a number of ways. It helps us to distinguish between different interpretations of the set-up of the problem; and it helps us to understand precisely what question causal decision theory is trying to answer. I appeal to Woodward’s theory of interventions to define when interventions are and are not possible. I show how causal graphs can be used to extend causal decision theories to certain kinds of unusual cases where one has knowledge about how one’s actions will turn out, for example, in cases involving time travel. Final, I will use the interventionist framework to describe a new type of case where causal decision theory seems to give bad recommendations.

Causality as a theoretical concept, intervention assumptions, and empirical content

Alexander Gebharter, DCLPS, University of Duesseldorf, Duesseldorf, GERMANY
Gerhard Schurz, DCLPS, University of Duesseldorf, Duesseldorf, GERMANY

In [anonymized] we argued that causality, as characterized within the theory of causal nets (TCN), satisfies two commonly accepted standards for theoretical concepts. In particular, we argued that (i) assuming directed binary causal relations obeying Spirtes, Glymour, and Scheines' (2000) causal Markov condition and causal minimality condition provides the best explanation of two statistical phenomena, viz. that two correlated variables X and Y become independent when conditionalizing on a third variable Z (screening off), and that two independent variables X and Y become dependent after conditionalizing on a third variable Z (linking up). In the second part we showed that (ii) TCN's core, i.e., the conjunction of the causal Markov condition and the causal minimality condition, is empirically empty. When one adds further axioms (such as different versions of faithfulness or the assumption that causation is forward directed in time) one gets, however, enriched TCN versions that have successively increasing empirical content. The first part of this talk summarizes and illustrates these findings, while the second part provides new results about TCN's empirical content. In particular, we present several theorems showing which logically possible probability distributions are excluded when
assuming independence of human interventions: All (or most) of a person’s actions manipulating variables of a person-external causal system that are experienced as “free” are probabilistically independent of those variables of the system that are non-effects of these action.

Constructing Causal Variables

Frederick Eberhardt, Humanities, Caltech, Pasadena, USA

Standard discussions of causal discovery presume that the world has already been represented in terms of causal variables whose causal relations are now to be determined. For example, in the now widely used causal Bayes net framework (Spirtes et al. 2000, Pearl 2000), it is assumed that one starts with a set of well-defined causal variables, for which statistical measurements are available, and the aim is to find the causal structure among those variables. Very little has been said about how one comes to find or construct these causal variables in the first place. It is known that the construction or determination of causal variables cannot be arbitrary, as a misspecification of the causal variables — such as when a variable is in fact a mixture of two others — can lead to erroneous inferences in the discovery methods. In this presentation I will give a positive account of how one can construct causal macro-variables from a set of micro-variables. I will illustrate this approach using image data as an example, where the pixels constitute the micro-variables, while the causal macro-variable is some higher level feature of the image. The account builds on the framework of computational mechanics developed in Shalizi (2001), but develops it to provide a more explicitly causal interpretation. The overall aim is to provide an automated approach to the construction of causal macro-variables from a set of micro-variables, that can be directly applied to the causal analysis of image and video data.

A Principled Approach to Defining Actual Causation

Sander Beckers, Computer Science, KULeuven, Leuven, BELGIUM
Joost Vennekens, KULeuven, Leuven, BELGIUM

The last decade has seen a proliferation of definitions of actual causation, yet little progress has been made in finding common ground between them. This is mainly due to the lack of a proper method for evaluating definitions on a fundamental level, as opposed to merely keeping tally on complex and exotic examples. We propose a principled way of building a definition from the ground up. First we define and motivate two essential concepts that outline the search space to look in: counterfactual dependence, which is a sufficient condition for actual causation, and production, which is a necessary condition. The first of these is commonplace in the literature. The second is a generalization of a
concept introduced by Hall, which we show to be a special case of ours. We argue that in most cases both concepts occur together, and that the problem cases from the literature appear when there is only production (e.g., Preemption, Switches, Overdetermination, etc.). The relevance of counterfactual dependence is easily understood in light of its similarity to predictive practices in science and engineering. Production, on the other hand, captures the more complex intuition of "bringing something about", which plays an important role in fields where counterfactual dependence is far less useful and/or harder to establish, such as history, ethics and medicine. Second, we develop a definition of actual causation as a suitable compromise between these two concepts. We do so by formulating two principles which constrain the space in the spectrum between them to a single definition. Third, we make all of this formally precise by using the expressive language of CP-logic (Causal Probabilistic logic), and prove that the principles introduced lead to our proposed definition. Finally, we compare several well-known definitions in the counterfactual tradition by locating them on the proposed spectrum.