

## Research Statement

Alison Fernandes

My research explains how relations like chance and causation fit into a scientific worldview, even when fundamental physics makes no use of them. Working in philosophy of science, physics and metaphysics, I develop accounts that characterise relations in terms of their use to us. By explaining how scientific relations help us predict, control and understand, we can reconcile them with fundamental physics. I particularly explore how relations that are temporally asymmetric can arise from time-symmetric fundamental laws.

My doctoral dissertation, *A Deliberative Account of Causation: How the Evidence of Deliberating Agents Accounts for Causation and its Temporal Direction*, investigates causation's place in science by considering its role in deliberation. Fundamental physics aims to be universal in scope and explain the success of other sciences. Yet it makes no use of causal notions. I argue that we make sense of how causal relations arise by relating them to the evidential relations agents use in deliberation. I begin by developing an 'epistemic model' that characterises deliberation in terms of the beliefs of deliberating agents. For example, Tamsin can't reasonably deliberate on taking her umbrella if she's certain she will. This model is then used to give a 'deliberative account' of causation, according to which causal relations correspond to the evidential relations agents use when they decide on one thing in order to achieve another. For example, Lance Armstrong's taking the hormone EPO *causes* an increase in his red blood cell production just in case his *deciding* to take it is grounds for thinking his cell production will increase. This correspondence explains why causation matters: knowing causal structure helps us make decisions that are evidence of outcomes we seek. This approach also explains why we control only the future, and why causes come *before* their effects—temporal asymmetries not reflected in the laws. Agents' decisions aren't evidence of past outcomes they seek when they properly deliberate. From this it follows that causal relations always go forwards in time. These asymmetries are ultimately traced back to a constraint over initial conditions of the universe, providing a new way of deriving causal asymmetry from temporally symmetric laws.

I have completed four papers based on this research. One paper, 'A Deliberative Approach to Causation', is forthcoming in *Philosophical and Phenomenological Review*. A second paper, 'Varieties of Epistemic Freedom' (2016) appears in the *Australasian Journal of Philosophy*. A third paper, 'Time, Flies, and Why We Can't Control the Past', is in press in an edited volume, *Time's Arrows and the Probability Structure of the World* (Harvard University Press). An additional paper, 'I Think, therefore I Will: Fichtean Insights into Freedom and Belief', is under review. I've presented this work at refereed conferences including the Philosophy of Science Association Biennial Meeting (2016), and the UK's Joint Session (2014, 2015), as well as by invitation at the Time Symmetry Conference, University of Sydney (2013), and the Serious Metaphysics Group, University of Cambridge (2014).

In related work, I use time travel cases to develop a temporally neutral method of evaluating counterfactuals and abilities. In 'Time Travel, Counterfactuals and the Open Future', I show

how current responses to the grandfather paradox presume a counterfactual asymmetry not reflected in the laws. In cases of time travel, however, there are strong causal and evidential reasons for giving up strict counterfactual asymmetries. In a second paper, 'Freedom, Self-Prediction and Time Travel', I investigate how a time traveller's evidence of her future behaviour constrains her freedom to deliberate. I use this constraint to motivate an evidential and temporally neutral approach to evaluating abilities and counterfactuals. I've presented this work at refereed conferences, including the American Philosophical Association Pacific Division Meeting (2017), as well as by invitation at the Causation and the Physical World Workshop, University of Cologne (2016). One paper is under review, and a second is to be submitted to *Noûs*.

My work on the AHRC project 'Time: Between Metaphysics and Psychology' uses studies from psychology to investigate our metaphysical assumptions about time. For example, we sometimes assume that if the future is open, it is worth caring about more. Subjects also judge a given number of hours of work to be worth nearly twice as much compensation if the work is described as taking place in the future, compared to the past. In one paper, 'Future-Self Bias?', I examine whether the effect supports a metaphysics of passage by considering whether it affects all future events, or merely those concerning our future selves. A second paper, 'How the Past Comes to Be Unchanging', investigates the role of causal concepts in our idea of a fixed past and an open future, by examining how young children's ability to place events on timelines relates to their ability to reason causally. These papers are to be submitted to *Philosopher's Imprint* and *Philosophical Quarterly*.

My next major project, *Chance in a Physical World*, investigates the place of chance in science by considering its role in guiding belief. We use chances to reason about the past and future. Candidate laws of fundamental physics are also, in important respects, temporally symmetric. Yet influential accounts of chance merely presuppose chance is temporally asymmetric: that events in the past have only chances of. In this project, I develop a temporally neutral account of how chance guides belief and apply this account to identify chances even in deterministic settings. A key hypothesis is that the universal nature of laws and the effective isolation of chance set-ups are crucial in allowing us to reason using chances. I've presented one paper from this research at the Society for the Metaphysics of Science Annual Conference (2017), and a second by invitation at the Second Law of Thermodynamics Conference, Munich Center for Mathematical Philosophy (2017). I plan to apply for an ACLS Collaborative Research Fellowship as project coordinator. I will approach Oxford University Press regarding publication of a monograph and submit a lead paper to *Mind*.

By examining how scientific relations are relevant to our needs, my research explains how these relations fit into the picture of the world presented by fundamental physics. This work gives a unified account of science without engaging in reduction, and explains temporal asymmetries without appealing to a primitive direction of time.