

# The Material Theory of Induction

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## Preface

The project for this volume started modestly. It was classified as the “little induction book” in my original notes. The plan was to write a short and easy introduction to the main ideas of the material theory of induction. As the writing proceeded, those modest ambitions were supplanted by increasingly ambitious ones until the project had ballooned into something enormous. There were three parts. The first dealt with qualitative notions of inductive inference and the second with quantitative notions. They correspond roughly to the chapters 1-9 and 10-16 of the present work. There was no space for the third part that dealt with the global structure of inductive support. It will be the subject of another volume. Readers anxious for a taste of its content should consult the Epilog here.

The principal idea of the material theory of induction is that background facts obtaining in some domain tell us which are the good and which are the bad inductive inferences in that domain. This conception differs fundamentally from virtually all approaches to inductive inference in the present literature. There the good inductive inferences are distinguished from the bad by checking whether the inference has appropriate formal properties, such as fitting to an approved inferential template or preferred calculus. Because the divergence from the present literature occurs at such a fundamental level, my experience is that philosophers of science who work in inductive inference have trouble approaching the theory. The difficulty, I conjecture, is that we approach new ideas by trying to assimilate them into our existing conceptual system, which has in turn been tailored to the details of our own research agendas. What are we to do when an idea arrives that does not neatly fit into any of our existing conceptual pigeon holes. Is this material theory just another variant of enumerative induction? Is it inference to the best explanation with some alternative notion of explanation? Is it the proposal of a non-probabilistic, mathematical calculus of inductive inference? Or is it another tiresome skeptical assault on inductive inference and the evidential grounding of science?

It is none of these. The slogans “All induction is local.” and “No universal rules of induction.” may appear skeptical. They are not. They are an attempt to diagnose why inductive inference has, for thousands of years, been a locus of trouble for philosophers. The words

“induction” and “problem” are nearest neighbors in any philosophical lexicon. This enduring, troublesome character derives, I believe, from a foundational mistake that was made at the outset. We tried and continue to try to understand inductive inference using the formal methods that have proven so fertile for deductive inference. While different formal approaches may work in different domains, the formal conception is the wrong approach for understanding inductive inference overall. Choosing it is responsible for the enduring trouble. The material approach offers an alternative foundation for inductive inference that repairs the trouble.

A prominent corollary of the material approach is that probabilistic methods do not provide a universally applicable account of inductive inference. For those enamored by Bayesianism, it will be tempting to drop the material theory into the pigeon hole occupied by formal luddites whose opposition to all mathematical approaches is grounded in a visceral antipathy to them. I do not belong in that company, as readers will see if they consult Chapter 16. My work elsewhere in history and philosophy of physics is very hospitable to mathematical methods, whose power continues to astonish me. I am especially impressed with the power of probabilistic methods in statistical physics. When they are applicable, they are wonders.

My advocacy and defense of probabilistic approaches extends to inductive inference, but only on a case by case basis. When probabilistic methods are warranted in some domain, they work and they work very well. Where Bayesians err is in their belief that probabilistic methods are a universal default that can be applied everywhere, automatically. Instead, my view is that probabilistic methods can be applied only in some domain when the background facts of that domain authorize it. We cannot just assume that they apply in some domain. We have a positive obligation to show that they are warranted by background facts in each case.

A consequence is that I wilt every time I see yet another paper that promises a Bayesian analysis of fiddle-de-dee, especially when fiddle-de-dee is some aspect of inductive inference or evidential support. The pretense is that the Bayesian analysis will provide universal understanding. It cannot do this since Bayesian analysis cannot be applied everywhere. Instead we are given a few elementary results in the probability calculus. The terms of these formulae are then matched tendentiously with terms of art from fiddle-de-dee. The relabeled formulae are supposed to provide insight, but they only give us the illusion of understanding.

The style of analysis of this work falls within my conception of history and philosophy of science. It begins by taking the pertinent science seriously. That is especially important when it

comes to inductive inference since the evidential successes of modern science are extraordinary. That we philosophers of science are struggling to vindicate these successes is more a commentary on our failures than any failure of the sciences. The chapters that follow are rich in examples from science. I lean towards grasping the science by exploring its history, for an emphasis on the history provides some protection from the inevitable, modern textbook simplifications of relations of inductive support. The presence of the history is not mere decoration. It is essential to understanding of the evidential relations in the science.

It is customary in a preface to acknowledge those who have been helpful in the book's project. This project has many distinct parts, commonly divided naturally by chapter. Rather than delivering here a long but opaque list of names, I have acknowledged in individual chapters those who have been especially helpful in those parts. Those acknowledgments fall short of naming all those who have provided support, encouragement or helpful critical responses. To all those I have failed to name, I offer apologies and thanks.

As I write these words in June 2018, there is a conference and a volume of papers in the planning stages on the material theory of induction. The conference will be held in October 26-28, 2018, at the Center for Philosophy of Science, University of Pittsburgh. I am indebted to all those who have taken a role in organizing and participating in the conference and even a little astonished at their interest. I thank them here: Jonathan Bain, Nora Boyd, Jeremy Butterfield, Hasok Chang, Richard Dawid, Siska De Baerdemaeker, John Earman, Balazs Gyenis, Eric Hatleback, Michel Janssen, Molly Kao, Jonathan Livengood, Wendy Parker, Dasha Pruss, Bryan W. Roberts, Elay Shech, Chris Smeenk, David Wallace and Porter Williams

Finally I offer the most profound gratitude to my wife Eve who has provided a happy home for my body and heart through the years of the writing of this work and many before it. Those who know the joy of true and enduring love will understand what that means. No combination of words can properly express it.