Preface

Time is generally thought to be one of the more mysterious ingredients of the universe. Perhaps some of the reason for this is that *understanding* is often a matter of finding analogies. But time is unique; there's nothing else remotely like it. Another, more tractable, source of perplexity is that the notion of time interacts in subtle and convoluted ways with a great variety of the deepest ideas in our conceptual scheme. It is this jigsaw puzzle that I am struggling with in the present essay. I try to make precise and explicit the interrelationships between time and a fair number of philosophically important ideas. To the extent that this is successful, time may seem to be not so mysterious after all.

This book is about phenomena, such as knowledge, causal influence, and entropy, that are biased with respect to time. Its primary focus is on questions like: Why is the direction of time from past to future? What is causation, and can it work backward? Could an act be rational if performed for the sake of a desirable past state? How is it that we know so much history, yet so little about the future? Can one properly explain the characteristics of a system in terms of its goals, rather than its origins? Why is there a profusion of decay processes but little spontaneous generation of order? And, finally, are there deep relationships among these temporally asymmetric phenomena? My principal thesis is that the asymmetries are indeed closely interconnected, and to sustain this claim, I offer a detailed picture of the explanatory links between them.

I shall be dealing with a constellation of notoriously problematic concepts—cause, knowledge, explanation, entropy, rational decision, law of nature, and counterfactual implication—and my secondary aim is to help clarify these ideas. Certainly there can be no presumption to have given complete, definitive accounts in the single chapters allotted to those topics. There can, however, be the hope that our concentration on time asymmetry, and the global treatment of all the ideas in relation to one another, will provide a simplifying

focus without loss of breadth and thereby enable us to make some progress toward a deeper understanding of each concept.

Readers who want an overview of the issues should begin at the beginning; but otherwise, because the chapters are each fairly autonomous, they can easily be taken out of order. The first half of the book concerns time more explicitly than the rest of it does. Thus, following the introduction (chapter 1), there are chapters devoted to the metaphysics of *now* (chapter 2), the meaning of the thesis 'time is asymmetrical' (chapter 3), entropy growth (chapter 4), how it is that we know so much about the past (chapter 5), and the possibilities of backward causation (chapter 6) and time travel (chapter 7). In the second half I turn to more familiar problems in the mainstream of philosophy, but considered from a temporal perspective. In particular, there are analyses of causation (chapter 8), explanation (chapter 9), counterfactuals (chapter 10), and rational choice (chapter 11) and, finally (chapter 12), a sketch of results and residual difficulties.

Although this work is in the philosophy of science, very little previous knowledge of science is presupposed, and there is no danger of anyone's being blinded by technical material. What little physics there is, is almost wholly confined to chapters 3 and 4, on anisotropy and entropy, and occasional sections elsewhere. These parts are self-contained, informal, and accessible to a nonspecialist. Moreover the rest of the book does not heavily depend on them.

The philosophical tradition to which this essay tries to contribute, began in earnest with Hans Reichenbach's classic work, *The Direction of Time*, published posthumously in 1956. This was the first attempt to give a complete account of temporal asymmetry. It was followed in 1963 by Adolf Grünbaum's *Philosophical Problems of Space and Time*, which endorses Reichenbach's views on most major points but provides a great deal of vital clarification and argument. Subsequently, a series of papers by John Earman (especially "An Attempt to Add a Little Direction to 'The Problem of the Direction of Time'" 1974) has brought to light some powerful objections to the Reichenbach/Grünbaum approach, and has helped to make clear what an adequate account must do. And in the last fifteen years, David Lewis has written half a dozen articles on counterfactuals, causation, and decision (collected in his *Philosophical Papers*, Vol. 2, 1987) which add up to a formidable theory of temporally asymmetric phenomena.

I hope that no one is offended by the unceremonious attitude I am going to take toward these pioneers of the subject. Despite the many disagreements I well know how much this work owes to their insight and example. It has also benefited from contributions by many others, and I am delighted to thank these people. Susan Brison talked

with me about large parts of the project, and gave friendship and encouragement. Ned Block and Josh Cohen commented on all the drafts of every chapter, constantly pushing me to try harder. I hate to think what this book would have been like without their generous and painstaking criticism. Judith Thomson applied her high standards of clarity and rigor, and helped me eliminate many obscurities. Jeremy Butterfield, Hartry Field, Sidney Shoemaker and Bob Stalnaker provided valuable detailed reactions to an early draft of the entire manuscript. Izchak Miller spent hours explaining to me Husserl's theory of our awareness of the passage of time. David Malament corrected several errors in my discussion of Gödelian time travel. Tom Kuhn and Larry Sklar did the same for the chapter on entropy. Mike Williams and John Carriero got me to see the force of Hume's ideas on causation. And I have had useful and enjoyable discussions with many other people, including Sylvain Bromberger, Jay Cantor, Ellen Eisen, Marcus Giaquinto, Bernard Katz, Fred Katz, Jerry Katz, and Abner Shimony.

Two parts of the book have been published before, and I am grateful for permission to reprint them. Chapter 7 is an improved version of an article, "On Some Alleged Paradoxes of Time Travel," which appeared in the *Journal of Philosophy* in 1975; and chapter 11, except for the final section, was published in *Philosophy of Science* in 1985, under the title "Decision Theory in Light of Newcomb's Problem." Finally, I would like to express my appreciation to the National Endowment for the Humanities and to the National Science Foundation.