OBSERVER MECHANICS

A Formal Theory of Perception

BRUCE M. BENNETT
Department of Mathematics
University of California
Irvine, California

DONALD D. HOFFMAN
Department of Cognitive Science
University of California
Irvine, California

CHETAN PRAKASH
Department of Mathematics
California State University
San Bernardino, California

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To our parents

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PREFACE

Observer Mechanics is an inquiry into the subject of perception. It suggests an approach to the study of perception that attempts to be both rigorous and general.

A central thesis of *Observer Mechanics* is that every perceptual capacity (e.g., stereovision, auditory localization, sentence parsing, haptic recognition, and so on) can be described as an instance of a single formal structure: viz., an "observer." The first two chapters of *Observer Mechanics* develop this structure, resulting in a formal definition of an observer. The third chapter considers the relationship between observers and Turing machines. The fourth chapter discusses the semantics of observers. The next three chapters present a formal framework in which to describe an observer and its objects of perception, and then develop on this framework a perceptual dynamics. Using this dynamics, chapter eight defines conditions in which an observer may be said to perceive truly. Chapter nine discusses how stabilities in perceptual dynamics might permit the genesis of higher level observers. Chapter ten comments on the relationship between the formalisms of quantum mechanics and observer mechanics. Finally, the epilogue discusses the philosophical context and implications of observer mechanics.

We want the ideas and principles in *Observer Mechanics* to be accessible to a wide audience; this dictates a rather informal style. On the other hand, we want to introduce a new formalism; this requires a fairly technical language and thereby restricts the audience. We have been advised to do one or the other, but not to attempt both. We have chosen, perhaps foolishly, to ignore this advice. We want to communicate to the nonmathematical reader as well as to the mathematical reader without seriously offending the sensibilities of either. Here, in outline, is how we have attempted this.

In chapters one through six, when mathematics is necessary to develop a point, we intersperse liberal explanations for nonmathematical readers. Chapters two, five, and six each have a section presenting basic mathematical notation and terminology. We intend these sections to be helpful references for readers having many different levels of mathematical sophistication. Chapters seven through ten are primarily mathematical; they are intended to give rigor to the intuitive discussions of the first six chapters.

For convenience in reference, we number in one sequence all definitions, terminology, figures, equations, propositions, and theorems. For example,

"Definition **5**–2.1" refers to the first numbered item in section two of chapter five. Figures are numbered in sequence with all other numbered items. For instance, a figure immediately following Proposition **6**–3.8 would be numbered "Figure **6**–3.9," even if it were the first figure in the third section of chapter six. At the top of each page we display the chapter and section. For instance, a page in section three of chapter four would have the display "**4**–3."

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B. M. Bennett
D. D. Hoffman
C. Prakash