Preface

What the nervous systems of animals let them do makes the greatest show on the planet. This book is about the minds of animals. Most of it concerns nonhuman animals and what they are capable of, with the last short chapter reflecting on the rise of humans and what might have made this species come to dominate this planet. The book is written as an introductory reference source for those with no knowledge of the fields featured: a large chunk of comparative cognition, but also behavioral ecology, evolutionary biology, neuroscience, perception, developmental psychology, anthropology, and philosophy. While the descriptions have been kept simple, the book has not shied away from some key ideas that could be highly complex. The reader will come across topics such as the perception of polarized light (Chapters 2 and 4), principal-components analysis (Chapters 12 and 17), and embodied cognition (Chapters 12 and 16). And while the book serves as a reference source, the writing style was steered away from the straight-and-narrow, cut-and-dried toward the lively and colorful, often not shying away from big words.

An introductory chapter (1) sets out evolutionary theory, crucial to the consideration of any aspects of behavior. Chapter 1 also lays out a brief history of the relevant fields of scientific study, in order to set the stage for the show to come. The two halves of the book then present a range of topics of animal thinking (Part I) and highlights on particular groups of animals (Part II). Part I starts off with the sensory world, the world from which animals get the information for everything that may be labeled "thinking" (Chapter 2). The ubiquitous phenomenon of learning is featured next, including both basic and more complex learning (Chapter 3). The next three chapters concern fundamental dimensions of experience that many animals process: space (Chapter 4), time (Chapter 5), and number (Chapter 6). A range of lab studies are described, along with naturalistic observations. All the knowledge of the world is useless from an evolutionary standpoint unless one does something with it. What to do depends on one's motivations; and emotions fuel motivations. Animal emotions are spotlighted in Chapter 7 in a comparative perspective. Chapter 8

describes the intricacies of the world of animal communication, offering a definition of *signal*, showcasing the wide range of signals, and explaining some of the functions of animal signals. Part I concludes with a potpourri of complex cognition, including planning, social learning, and cognition about the minds of others.

Part II brings on nine chapters on a diverse range of animals with "star" characteristics. Although the list is biased toward those animals more closely related to humans, three groups of invertebrate animals take the stage. Honeybees (Chapter 10) are perhaps the world's economically most important insect. Worker bees can do an amazing lot of things with tiny brains. Jumping spiders (Chapter 11) have some of the best invertebrate eyes, which they use in active hunting. They stalk like miniature tigers of the undergrowth, and like honeybees, they accomplish much with tiny brains. Cephalopods (Chapter 12), on the other hand, have some of the biggest nervous systems among invertebrate animals. These mollusks include squids, cuttlefish, and octopuses. Among the fascinating behaviors highlighted, they display patterns on their skins, controlled by their nervous systems, and they play. Two groups of birds with large brains relative to their body sizes then enter on stage. Corvids (Chapter 13) are a family that includes crows, ravens, and jays. Depending on the species, they excel at different kinds of behaviors—from spatial memory to tool use to planning. Parrots (Chapter 14) comprise a large group of birds showing clever behaviors. An alpine parrot that raids garbage bins, the kea, and one African grey parrot that has learned some language take starring roles. Three different mammals then take the stage. Dolphins (Chapter 15) have huge brains relative to their body size, and they exhibit a wide range of smart behaviors, although everything they accomplish is also done by less brainy animals. Dogs (Chapter 16) have coevolved with humans. Much of their cognition has been forged in this coevolution—including, especially, their sensitivities to humans. Great apes (Chapter 17) are our nearest cousins. They are like us in many ways, except that all of them are teetering on the verge of being wiped out in the wild. The chapter not only highlights some of their smart behaviors, but also considers why so few great ape species have survived to this day. What is it about the extant (surviving) lot that has carried them? The last chapter (18) contains a brief discussion of the rise of humans. It includes four commentaries from distinguished authors who have thought about this issue.

The curtain calls (end of the book) include a glossary and a reference list. The glossary provides brief definitions of key technical terms and also describes a few key persons in the history of the field. The reference and materials list contains the few bibliographic sources mentioned in the book, and also other materials, including video clips, that might interest readers.

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Ken Cheng
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