

PREFACE

The field of comparative cognition can trace its origins back to René Descartes and John Locke, who believed that cognitive processes rested solely with humans. Later, Charles Darwin and Herbert Spencer dramatically disagreed; they proposed instead a continuity of mental capacity across species, including humans. Although Darwin's evidence for cognition in animals was largely anecdotal, he set the stage for the scientific study of cognition in animals that was to follow.

In his *Introduction to Comparative Psychology*, written at the end of the 19th century, C. Lloyd Morgan anticipated the advent of behaviorism—an objective, mechanistic approach to the study of behavior—with his classic dictum, now known as Morgan's canon: "In no case may we interpret an action as the outcome of the exercise of a higher mental faculty, if it can be interpreted as the exercise of one which stands lower in the psychological scale." This appeal to parsimony remains the foundation on which research in comparative cognition has rested for more than a century.

Edward C. Tolman, who considered himself a behaviorist, was a pioneer in the field that has become known as comparative cognition. Tolman exemplified an approach that encouraged speculation about cognitive processes, but empirically tested predictions based on cognitive processes against simpler behavioral mechanisms. This approach is the hallmark of modern comparative cognition (see Zentall, 2002).

Although behaviorists of his day criticized Tolman for "leaving the rat buried in thought" at the choice point in a maze (Guthrie, 1935, p. 172), the results of his latent learning (Tolman & Honzik, 1930) and cognitive map experiments (Tolman, 1948) have inspired many later researchers. Beyond his cognitive hypotheses of latent learning and cognitive maps, Tolman's research was characterized by carefully controlled experiments involving objective measures of choice and latency of response.

Many years later, with the 1978 publication of *Cognitive Processes in Animal Behavior*, a volume edited by Hulse, Fowler, and Honig (and reviewed by Wasserman, 1981), the field of comparative cognition demonstrated that it had collected a critical mass of researchers who were actively engaged in this hybrid discipline. This pioneering volume brought together chapters by several researchers who addressed many of the same problems that attracted cognitive psychologists who studied humans.

The field of comparative cognition has grown dramatically in the more than 30 years since the appearance of that classic edited volume. A clear indication of the attraction of researchers to this field can be gleaned from the history of the Conference on Comparative Cognition (CO3). The first informal meeting of

CO3 was held in March 1994 in Melbourne, Florida, with about 30 participants. It became formalized in 1999 with the founding of the Comparative Cognition Society. And it now attracts over 150 participants to a conference that has expanded to 4 days. To better integrate this field with more traditional cognitive science, in 2008, fall meetings of CO3 were added as a satellite to the meeting of the Psychonomic Society.

Several years ago, we recognized the need for a volume that, on the one hand, would represent the breadth of interest in comparative cognition research and, on the other hand, would characterize those approaches represented by carefully controlled research designs applied to a diverse set of questions about the cognitive processes of animals. For that purpose, we brought together chapters written by investigators who were doing state-of-the-art research to collaborate on *Comparative Cognition: Experimental Explorations of Animal Intelligence*, which appeared in 2006. In the years since that volume appeared, additional advances in comparative cognition research encouraged us to update, expand, and formalize research in the field of comparative cognition in the form of the present *Handbook*.

The *Handbook* is divided into sections that roughly correspond to increasing levels of behavioral complexity. The first set of chapters deals with the way that animals perceive the world. In them, investigators ask: Do other animals see and hear events in their world as we do? Do they suffer from the same illusions as we do? And are similar perceptual mechanisms involved in the way they represent their world?

The second group of chapters deals with attention and search. When animals are searching for a target, how do they do so? How do they recognize objects?

The third section comprises chapters that examine the attribution of causation. At one time, causation was believed to be explainable in simple Pavlovian terms. It was assumed that if a stimulus repeatedly preceded an important event, then the occurrence of that event would be attributed to the stimulus. Recent research has suggested that more complex cognitive processes may be involved; in many cases those processes may be similar to human judgment of causal relations.

The fourth section of the *Handbook* deals with the broad topic of memory. It starts with a chapter that identifies a number of methodological issues that arise when one tries to compare memory in humans with memory in other animals. The section then addresses the question of whether animals are capable of episodic memory (the ability to metaphorically travel back in time) and future planning. The last two chapters in this section deal with investigations of the neural basis of memory.

The fifth set of chapters covers research on spatial cognition and addresses how animals use landmarks and other means of navigation. This section also examines the remarkable ability of birds to remember where they cached food for later recovery.

The sixth section of the *Handbook* covers the topics of counting and timing. The authors of these chapters discuss how these abilities can be disentangled and studied to develop models to account for the functioning of these skills.

The seventh section deals with categorization and concept learning. It asks how animals develop stimulus classes and how they process the relations among stimuli as well as their absolute properties.

The eighth section of this volume is concerned with the degree to which animals can learn about the temporal, spatial, and conceptual patterns of events: from learning the rules that govern the spatial pattern of reinforcers to learning the meaning of randomness and the rules associated with an artificial grammar.

The ninth set of chapters deals with several intriguing phenomena concerned with problem solving and behavioral flexibility. It includes chapters that explore some of the challenges in the measurement of animal intelligence. It also includes research on tool use, as well as an analysis of the ability of animals to form transitive inferences, a behavior that closely resembles the human ability to logically draw conclusions from given premises.

The last section of the *Handbook* describes programs of research that involve social cognition in animals. These chapters examine the possibly predisposed tendencies of rats to socially transmit taste preferences and of dogs and wolves to interpret human pointing gestures. The chapters also explore the mechanisms involved in some of the more complex forms of social cognition implied by research on imitation.

Finally, in memory of Stewart Hulse, we have reprised the epilogue that he wrote for the 2006 volume. Stew was not only a driving force behind the first edited volume in the field of comparative cognition, but he also served as the editor of the *Journal of Experimental Psychology: Animal Behavior Processes*, one of our premier journals, and as a mentor to many researchers in the field. We owe him a great debt.

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