

# Preface

“Dogs,” the developmental psychologist Paul Bloom declared in 2004, “are the next chimpanzees.” Bloom was right: while chimpanzees were the stars, and, with other primates, the primary subjects of comparative cognition research for decades, in the last 15 years their dominance has been challenged. In the late 1990s, research with dogs began to appear intermittently in major scientific journals of behavior and cognition; since that time, the number of scientific papers written about dog abilities has skyrocketed. “Dog labs” dedicated to studying the behavior of the species have been developed internationally, and dogs have been accepted as (and indeed are becoming) some of the most well-researched and interesting subjects of contemporary psychology and ethology.

The field of “animal cognition” is motivated by an interest in the description of animals’ capacities and mental processes (including beliefs, desires, memories, and other cognitive content), especially insofar as it is explanatory of behavior. It began developing in the mid-twentieth century, arguably spurred by Donald Griffin’s 1976 *The Question of Animal Awareness*, which legitimized questions of the mental experience of animals. By 1998, the field had grown sufficiently that the journal *Animal Cognition* (Springer) was launched. The current volume is concerned with a veritable subfield of animal cognition: “dog cognition.” Here, too, investigation on dogs has quickly escalated: a 2002, 50-essay volume on animal cognition contained only one essay using dogs as the main subject model (by a contributor in this volume, M. Bekoff).

While there are now many multi-author volumes dedicated to the study of nonhuman primate cognition and animal behavior and cognition in general, no edited academic volume on *Domestic Dog Cognition and Behavior* currently exists. Thus, the current volume represents the first compilation bringing together the writings and research of a number of the leading and most forward-thinking researchers in the field. The authors include the head of the preeminent dog research program at Budapest’s Eötvös University; the principal investigators at the University of Veterinary Medicine in Vienna; the heads of the University of Arizona and of Barnard College’s dog cognition research groups; as well as some of the first biologists and researchers to study dogs and to write about their cognition; early, renowned investigators of the dog–human bond and effects of domestication and breed; and experts in olfaction, social cognition, and comparative canid work.

Though some research, and some of these researchers, emerge from a “comparative” perspective—which science is concerned with comparing the behavior and abilities of animals, especially human and nonhuman—others come from veterinary, cognitive science, and ethological backgrounds. Instead of being a corpus of comparative findings, therefore, this volume is designed to describe the results of the dog *qua* dog. The results of studies are used to draw a picture, inasmuch as it is possible, of the capabilities of dogs as subjects of interest themselves.

Dogs are not a new subject of study, but this interest in exploring the species’ behavior for its own sake is new. Pavlov’s dogs were used to demonstrate a form of learning which is seen in most animals (Pavlov 1927); Darwin, for his great personal interest in dogs, studied domesticated animals as a means to understand how artificial selection worked (Townshend 2009). Neither’s research was intrinsically motivated by the dog; indeed, Pavlov’s invasive work, including decerebration, could be seen as antithetical to developing an understanding of the behaving dog *per se* (Pavlov 1927).

My own arrival upon dogs as a research subject emerged from a comparative interest as well. When I began studying dog behavior, only 15 years ago, it was not dogs as a species which intrigued me. Instead, I was in search of any animal behavior which could give insights into the mental experience and cognitive understanding of the species, on average. In particular, I was interested in identifying behaviors from which one might be able to infer the presence or absence of a “theory of mind” in animals. Investigation of such “metacognitive” topics as theory of mind, or understanding of the intentionality of others’ behavior, is notoriously intractable with nonverbal animals: most studies of human metacognition require verbal response or confirmation from subjects to confirm presence of an ability. Experimental metacognitive paradigms with nonhuman animals have usually led to ambiguous results, and even in cases where a species “passed” the test, alternative explanations for their behavior were easy to find (Shettleworth 1998). Given that any metacognitive ability in animals must have a function in ordinary intraspecific interactions, I went in search of a naturally occurring behavior tightly linked to the development of theory of mind. In human children, social and pretend play are implicated in development of metacognitive abilities (and an absence of play, in some children’s difficulty with theory of mind) (see, e.g. Baron-Cohen et al. 1993). Thus I began to look at play in animals to see if it had any of the markers of consideration of others’ states of mind. Domestic dogs regularly engage in intraspecific and interspecific play, up to one-third of their awake life as juveniles, and continuing into adulthood (Bekoff and Byers 1998; Fagen 1981; Horowitz 2002). Through detailed characterization of their behaviors in dyadic social rough-and-tumble play, I found that dogs used communicative play signals with sensitivity to the attentional state of a potential playmate, and used attention-getters suited to the level of inattention of the audience, often in order to gain attention before play-signaling (Horowitz 2002, 2009). This presaged the now myriad findings of the dogs’ ability to identify and use human attentional states (e.g., Call et al. 2003; Schwab and Huber 2006).

In terms of metacognition, the main result of the play research was a suggestion that dogs may have a “rudimentary,” inceptive theory of mind (Horowitz 2009); but the recognition of dogs as a viable and somewhat surprising research subject was the other practical result of the research.

**The dog** Domestic dogs are members of the Canidae family, along with social carnivores like the wolf, dingo, fox, coyote, and jackal (Serpell 1995). *Canis familiaris*<sup>1</sup> is the only canid species to be fully domesticated. Archeological evidence suggests that domestication of dogs, from wolves, *Canis lupus*, began at least 10–15,000 years ago, about the time that nomadic hunter-gathering humans settled into more agricultural societies (Clutton-Brock 1999), and perhaps at multiple locations (e.g. Boyko et al. 2009)—although mitochondrial DNA from wolves and dogs dates their divergence to 145,000 years ago (Vilà et al. 1997).

Dogs were also the first domesticated animal (Clutton-Brock 1999). This was surely due in part to their social nature, but also implicated must be their ancestors’ willingness or ability to change behavior importantly in response to human behavior. Although humans have long explicitly bred animals for specific characteristics, domestication generally begins with a gradual association of a species with humans, whereby successive generations grow tamer and, finally, behaviorally and physiologically distinct from their wild ancestors. In particular, one speculated origin of domesticated dogs is that ancestral wolves began to exploit the new ecological niche that was trash-heaps, or “dumps,” on the periphery of early human communities; these wolves may have been, tended to, occasionally eaten by, but generally tolerated by human (Coppinger and Coppinger 2001; Fuller and Fox 1969; Serpell 1995). Human selection began perhaps inadvertently by allowing those animals that were useful or pleasing to survive, while deterring or destroying those that were not (Hale 1969).

This earliest artificial selection would have favored an animal that was flexible in its behaviors, able to, to some extent, anticipate human (interspecific) behavior, and not strongly territorial. Belyaev’s famous study creating a cadre of what he called “domesticated elite” foxes by selecting those who reacted to humans non-aggressively or fearfully (Belyaev 1979; Trut 1999) indicates that domestication may change behavioral thresholds (as of a fear response, predatory urge, or aggression).

Artificial selection for the characteristics that comprise today’s current dog breeds began relatively recently, only 200 years ago, with the rise of dog “fancies.” Breed “standards” appeared which listed the desired traits for members of a breed, which individuals were interbred to perfect the line (Garber 1996). The physical and behavioral diversity apparent in today’s dog population arises from this intensive (and often destructive (Asher et al. 2009)) breeding practice.

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<sup>1</sup> Throughout the volume, authors alternately use the Latin *Canis familiaris* and *Canis lupus familiaris*. Though the former is the current Linnean term in most favor, the latter reflects the belief that the dog is but a sub-species of wolf, having evolved therefrom.

In the U.S. alone, there are an estimated 75 million owned, pet dogs, both purebred and mixed breed. These animals are but a fraction of the stray, free-ranging, and owned dogs worldwide. The ubiquity, and, to a great degree, the success of this species at living with and among humans makes them a compelling subject.

## Parts of the Volume

The current volume is divided into three parts, each highlighting one of the different vantages relevant to providing a full understanding of the dog. **Part I** includes chapters providing orientation on the subject, such as the perceptual abilities of dogs and the effect of interbreeding. Surprisingly, while olfaction is the dog's primary sensory modality, few academic papers on or about dogs begin with an assessment of this skill and describe its relation to the behavior of the species. This volume remedies that, opening with **Gadbois and Reeve's** detailed summary of the science of canine olfaction, from physiology to proposed processing systems, and including various methods for assessing and training dogs. They discuss the relevance of the species' olfactory ability in the context of experimental work and applied fields, such as in disease detection. Next, **Serpell and Duffy** describe the contributions of a dog's breed on its behavior, using the well-validated owner questionnaire developed by Serpell and others (C-BARQ) to hypothesize about the bases for various behaviors, both desired and undesired. In this way, they explore the genetic, functional, and inbreeding-related origins of behavior. Finally, canid ethological work with dogs is reviewed and advocated for by **Bekoff**, who uses results from play and scent-marking studies to highlight the value of observational studies of dogs, reminding us of the opportunities available, and the methods necessary, to study this animal in detail.

**Part II** reviews observational and experimental results from studies of physical and social cognition, such as learning and social referencing. To begin, **Huber, Range, and Virányi** describe results from their and others' labs on what is broadly called "social learning" in dogs: essentially, learning how to do an act by seeing it done. They consider the different kinds of learning, including social facilitation and various levels of imitation. By critically assessing the differences between kinds of imitation, they provide an acute lens on the current state of the field.

Perhaps the most widely researched field of dog cognition is "social cognition." Even without the white sclera of the human eye which, it has been posited, allows humans to more distinctly see the gaze casting out from the iris, dogs share with us the willingness, even interest, in making eye contact. **Prato-Previde and Marshall-Pescini** argue that the social cognitive ability of dogs arises in part from this change. They review the wide-ranging studies of how dogs use their own, conspecifics', and humans' gaze—from interspecies social referencing, to dogs' use of human communicative cues—as well as exploring the meaning and communicative value of this "looking." Elaborating on that work, **Rossi, Smedema,**

**Parada, and Allen** make the case that social cognitive skills of dogs reflect in part a kind of coevolution between humans and early domestic dogs. They describe preliminary work with an eye-tracking device which can determine gaze in a free-moving dog that is participating in a gaze-following task. By assessing the way the dog visually scans human gestures, they contribute to a better understanding of what the dog is experiencing in various experimental settings. This research, as with all work on social cognition, is also an exploration of the commonalities of the dog-human social group.

Finally, **Fiset, Nadeau-Marchand, and Hall** investigate the physical cognitive abilities of hand-reared, captive (but not pet or tame) wolves as a way to reflect upon what of *Canis lupus* is left in *Canis familiaris*. In particular, they report results of tests of development of object permanence and sensorimotor skills in young wolves, and compare these to the available results from domestic dogs. The differences as well as the similarities put a useful lens on what is changed by the process of domestication and artificial selection.

**Part III** nicely ties up and reflects upon the work in the fields of dog cognition and behavior to date, in chapters reviewing the various conceptual and methodological approaches in the field, testing anthropomorphisms made of dogs, and developing practical application for behavioral and cognitive results to be used in animal welfare. **Fugazza and Miklósi** begin by critically assessing the methods used to study dogs in much of the research described above. Since researchers of the field come from a wide array of backgrounds, methods do not always converge, and the corpus of knowledge on the species is being built, they argue, somewhat haphazardly. They encourage a consensus based in ethology and on sharing data.

Among those estimated 75 million owned dogs in the U.S., there are presumably a few that are not anthropomorphized by their owners. But not many. Anthropomorphisms are relevant to the drawing of a complete picture of the species dog because they reflect an *anthropocentric* attitude that not only are dogs smaller, furrrier versions of humans, but also that they are valuable or interesting (as scientific subjects or even as animals) only insofar as they resemble us. **Horowitz and Hecht** instead argue for replacing this perspective with a more dog-centered research program. They describe work from their lab testing the context of behavior that prompts common anthropomorphisms of dogs. Like Fugazza and Miklósi, they reflect on the dog research to date and identify anthropocentric as well as more dog-centric elements of published research paradigms.

Next, **Udell, Lord, Feuerbacher, and Wynne** follow Fiset et al. in looking at hand-raised, captive wolf behavior, but in their case they use it to argue for a revised understanding of who the dog is. In particular, they describe their work which reassesses the cognitive and developmental differences between wolves and dogs. Also reflecting on the approach of the dog research to date, they observe that most research in the field is with owned dogs in first-world countries, which, they argue, is not just the numerical minority of dogs currently alive, but also may not be a representative sample of the extant species members.

The volume ends with a chapter considering how our growing, if incipient understanding of the dog can be used practically to affect the lives of all dogs.

An appraisal of the good measures of health, emotional experience, as well as cognitive abilities of the dogs can be used to propose a wide-ranging dog welfare framework, as begun by **Rooney and Bradshaw**. Their chapter is a comprehensive and important integration of many of the topics of this volume into the foundations of a practicum for vets, handlers, kennel workers, and dog owners alike.

*Domestic Dog Cognition and Behavior: The Scientific Study of Canis familiaris* highlights the state of the field in this new, provocative line of research. Chapters considering past methods and work and initiating novel lines of inquiry draw a fuller picture of the behavior of the domestic dog than has ever been done. These pages also represent a move toward considering and studying domestic dogs for their own sake, not only insofar as they reflect back on human beings.

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