Foreword

Gay Bradshaw's goal in writing this book is extremely ambitious—to attempt to synthesize the biological, neuroscientific, psychological, and psychiatric literatures to provide a deeper understanding of the behavior, brains, and minds of carnivores. That said, she is uniquely qualified to write this volume. Over the course of her prolific career she has studied and worked intimately with a diverse array of species as an ethologist, psychologist, and indeed, psychotherapist of animals. In addition to possessing a remarkable breadth of experience, she is extraordinarily adept at not only reporting very recent advances within a number of different scientific literatures, but also creatively bridging the data and forging conceptual links across these bodies of knowledge. Working at the cutting edge and the interface of disciplines, this groundbreaking book is an exceptional feat of scholarship. In this labor of love Bradshaw offers the reader the wealth of her own experience—near observations of the social and emotional behaviors of a number of different animals in the wild—along with numerous reports from the world's leading biologists who have also worked closely with various carnivore species. Even more, she presents a compelling theoretical integration of biology and psychology to model the deeper brain-mind mechanisms that underlie the adaptive functions that have contributed to the survival of both carnivores and humans.

The keystone of Bradshaw's model lies in the synthesis of a rapidly expanding body of very recent research on the neurobiology of social and emotional abilities in both humans and animals. Indeed this interdisciplinary perspective characterizes her earlier studies of elephants, who share very specific "higher" functions that are admired by humans. But here she leaps

from the mind of a gentle giant into the minds of various carnivores who are most feared by humans. In the following chapters, she offers numerous evocative portraits of the cognitive and particularly social and emotional functions of the carnivore's mind. To shift the focus of scientific inquiry from outer behavior to a deeper understanding of the inner world of carnivores, Bradshaw offers a neurological lens through which to view their natural histories, and so brings to light "neuroscience's long-standing, species-common model of brain, mind, and consciousness." Note the bold leap from the science of the behavior of individual animals in natural physical environments to the science of interacting animals, emotion, and consciousness in social environments.

The linchpin of Bradshaw's model is the integration of biology and neuroscience to generate a greater apprehension of the common adaptive (and maladaptive) social and emotional mechanisms that are shared by humans and all animals, including carnivores. In particular, at various points Bradshaw describes ongoing research in humans on brain lateralization and the functional asymmetry of the two cerebral hemispheres. She specifically refers to research in humans on the critical role of right lateralized cortical-subcortical systems involved in processing social and emotional information, and to the "mammalian right hemisphere's socioaffective centers—the areas key to stress regulation, self-development, and affiliative behavior." Here I'd like to point out that there already exists a sizable literature on brain and behavioral lateralization in animals. For much of the last two centuries science held the erroneous assumption that because only humans possess left brain specializations for language, brain lateralization was a uniquely human function. With the onset of this century, however, brain laterality research in animals has exploded. It can now be used to offer important insights into the minds of carnivores, and indeed into common nonverbal psychoneurobiological survival mechanisms of not only mammals and humans, but also all vertebrates.

Indeed, two recent influential comprehensive reviews cite a large body of research that documents the lateralization of specific functions of the right and left brains in both domesticated and wild animals in their natural habitats.[1] This burgeoning transspecies literature on hemispheric dominance

also reports structural and functional differences in the two hemispheres of the human brain, showing continuity of these lateralized functions across the phylogeny of species. It is now thought that the evolutionary mechanism of brain asymmetry in vertebrates emerged about five hundred million years ago. From this point of origin the right hemisphere, the primary seat of emotional arousal, is believed to have become specialized for detecting and responding to unexpected stimuli in the environment and for controlling escape and other emergency responses, in contrast to the left brain, which originally became specialized for controlling well-established patterns of behavior under ordinary and familiar circumstances. To sustain these lateralized functions, the right hemisphere utilizes a global form of wide-ranging attention to attend to novelty, while the left uses a narrowly focused attention. For example, there is now agreement that in fishes, amphibians, reptiles, birds, and mammals the right hemisphere is specialized to detect and rapidly escape from carnivores while the left hemisphere is specialized for "prey" capture, a finding directly relevant to the theme of this book. These studies demonstrate that across species, animals keep a watchful left eye on any visible carnivores, respond more strongly to a potential carnivore seen on their left side, and react with greater avoidance to carnivores seen in the left side of their visual field (right side of the brain) than in their right visual field.

Another shared major tenet of both animal and human brain lateralization research is that the development of hemispheric specialization is strongly influenced by social attachment experiences and reproductive hormones in early life, and that stimulation of the developing young leads to profound and long-lasting alterations in hemispheric control, especially in the regulation of emotions. Supporting Darwin's pioneering work on the expression of emotions in man and animals, it is now held that "the right hemisphere is dominant in the control of strong emotions, especially hostility and aggression, as demonstrated by increased levels of blood flow and neural activity in regions of the right hemisphere when these emotions are expressed."[2] In addition, both literatures document that early social context indelibly influences the most fundamental structural system involved in stress regulation—the hypothalamic-pituitary-adrenal axis—and that for the rest of the lifespan

the right hemisphere controls physiological stress responses and cortisol production. Parallel with this discovery are those from animal and human studies clearly indicating that the long-term effects of early traumatic social stress include a shift to a cognitive-emotional bias toward a predominant negative state and an enduring alteration of right brain functions, expressed in future impaired abilities for coping with social stress and a predisposition to post-traumatic stress disorder.

In sum, then, the discussions of nonhuman animals in this book are congruent with human models of interpersonal neurobiology, an interdisciplinary perspective that focuses on how early social-emotional attachment experiences, for better or worse, shape the developing brain/mind systems. Bradshaw's earlier application of human interpersonal neurobiological models of development to anthropogenically stressed elephant populations established the validity and utility of understanding the animal psychopathology of "brutal killing and sexual assaults of rhinoceroses" in terms of early relational trauma-induced post-traumatic stress disorder. This novel conceptualization of the origins and expression of aberrant animal behavior in terms of these human models shifted the paradigm for wildlife biology.

Equally ground-breaking, Bradshaw masterfully provides evocative and compelling insights into the minds of a spectrum of carnivores, attempting to counter the extant demonization and destruction of these species. Although anthropomorphism was viewed as an antiscientific principle, humans have a long history of freely projecting their worst fears and aggressive tendencies onto the animals in this book. In addition to imparting a deeper understanding of the consciousness of animal minds, then, Bradshaw brings to light the "vanquishing myths that mask the true identity of carnivores," and offers a plea for the ethical responsibility of our species to the welfare of other species that co-inhabit the planet. Bradshaw calls for not only a deeper understanding of the minds of carnivores and wildlife in general, but also a new paradigm that "demands a change in how the world is perceived and . . . a change in how we ourselves are viewed."

Ultimately, this change entails more than coming to a deeper understanding of the consciousness of carnivores: it requires investigating various states of consciousness of humans, the apex carnivore of the planet and the dis-

rupter of free-ranging populations of carnivores. This kind of expanded self-inquiry must include both the reflected objective awareness of the human surface, conscious mind located in the left brain, as well as the reflective empathic social-emotional awareness of the deeper unconscious mind located in the right brain.

As the reader will see, the creative narrative style of this book includes frequent descriptions of social-emotional communications between animal minds and bodies. Offering more than an abstract, left-hemispheric, objective, and "coldly scientific" discussion of animal behavior, Bradshaw writes in a right-hemispheric, emotionally evocative, imagistic way, describing not just the behavior but also the carnivores' subjective states of mind. By doing so, she moves them away from cold, lethal abstractions, helping us to understand them as sentient living beings with intimate social needs and emotional and motivational systems that are in some very basic ways similar to those of humans.

Indeed, as a colleague and coauthor I can attest to Gay Bradshaw's remarkable abilities as a scientist to fully engage her right brain creativity and curiosity to make intersubjective contact with the emotional subjectivities of a wide variety of animal species. Going beyond the now established principle that animals, like humans, have adaptive emotions and engage in intensely social lives, she uses her own intuitive, bodily based emotional reactions to read the external outputs and internal states of mind of the emotional brains of animals. This orientation is also central to her pioneering studies on the psychobiological treatment of traumatized animals with methods that access right brain empathy, a central mechanism of change in the human psychotherapy literature.[3] The studies she reports here of her own work as well as that of other biologists studying carnivores in an experience-near fashion are establishing not only the importance of research on the interpersonal neurobiology of intraspecies social-emotional communications, but also the validity of interspecies communication as a scientific method in behavioral biology.

As Bradshaw repeatedly demonstrates, to develop a more comprehensive understanding of the natural lives of carnivores, biologists need to move from the stance of detached observer to that of participant observer, and to

read their subjects' intimate right-brain-to-right-brain communications when they are in a state of safety with a human being. The formal study of animals within their relational contexts not only enriches our scientific understanding of nature, but also can offer invaluable and deeply rewarding emotional experiences and expansions of human consciousness (see the remarkably evocative, inspiring description of human contact with sperm whales in the Epilogue).

But as the reader will soon see, the following pages contain more than uplifting, positive glimpses into the psyches and lives of the "toothed and clawed." Bradshaw vividly describes not only her own observations but also those of other scientists who are documenting the rapid anthropogenic decline of the "wild" species described in this book. These disturbing images of humans' destruction of the biota are strongly reminiscent of Rachel Carson's evocative descriptions of a changing botanical landscape blighted by the unrestricted proliferation of chemical pesticides, another form of anthropogenic disturbance. Her transformational *Silent Spring* was a call for action that compelled changes in governmental regulation. In this similarly trailblazing volume Bradshaw urgently and passionately sounds a similar clarion call for political action and moral change in our relationship to not only carnivores but also the natural world.

This pioneering work makes important and indeed essential contributions to ethology, the branch of science that deals with animal behavior, especially in the wild, as well as to conservation biology, the branch of biology that deals with threats to biodiversity and with preserving the biologic and genetic diversity of animals and plants. It is therefore essential reading for not only researchers, conservationists and policy makers, but for anyone who cares about the welfare of life on our planet. It is my hope and prediction that this extraordinary work will become a classic and transformational volume in both the biological and psychological literatures.

Allan N. Schore

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