

Primate, Cetacean, and Pinniped Cognition Compared: An Introduction

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When we were students attending our first Society for Marine Mammalogy conferences, a small but devoted group of us would eagerly search the conference schedule for talks on cognition and social behavior. Although there were never many in the offering, we could almost always find a couple of great presentations. The latest works from the cognitive science laboratories of Herman (e.g., Herman, 1980; Herman et al., 1984; Herman & Forestell, 1985), Schusterman (e.g., Schusterman et al., 1986; Schusterman & Gisiner, 1988; Schusterman & Kastak, 1993), and Roitblatt & Nachtigall (e.g., Roitblatt et al., 1993), for example, were among the high points for us of each five-day, biennial event. And, if there were indeed any reports on social behavior from the field (see reviews, this issue), they would make the conference an especially exciting one for us.

There were, of course, good logistical reasons why talks on such topics were so few and far between. Identifying individuals, tracking their relationships, and collecting data on their social interactions underwater pose a daunting challenge to even the most intrepid, and well-funded, field biologists. Maintaining marine mammals in the laboratory was likewise difficult and expensive, and funding for research on the cognition of these alien creatures, so different from ourselves, was, and continues to be, particularly hard to come by. But, inspired by the research that had, against these odds, provided such fascinating glimpses into the cognitive and communicative skills of these animals, we were determined to do more of the same. Many of the people who have worked to carry on that tradition are, happily, represented in this issue.

We, the Guest Editors of this special issue, also went off to try and do our part. One of us (Herzing) established a field site in the Bahamas at which audio-video recordings of social interactions among wild, but human-acclimated, dolphins have now been the focus of study for over twenty years

(e.g., Herzing, 1996, 1997, 2000, 2005; Herzing & Johnson, 1997; Au & Herzing, 2003). The other (Johnson) has studied dolphin social behavior in the field (e.g., Johnson & Norris, 1986, 1994; Johnson & Moewe, 1999), as well as dolphin and sea lion cognition in the lab (Schusterman et al., 1983; Johnson, 1990; Bauer & Johnson, 1994). In recent years, however, Johnson has shifted to primarily studying primate behavior instead (Johnson et al., 1999; Johnson, 2001). It was this shift to comparative studies that provided the kernel that was to grow into the workshop upon which this issue is based.

Given the close genetic relationship between humans and other primates, there long has been a strong impetus to study our simian kin, to learn more about both our origins and our uniqueness as a species. In both the laboratory and the field, research on primate sociality and problem solving has been pursued with great vigor and ingenuity, producing, over 100 years, a literature vast compared to that available, even now, on marine mammals. And yet, as different as, say, a dolphin and a chimpanzee may be, it has become, especially in recent years, increasingly obvious that there are many striking parallels between these taxa. Their relatively large brains, sophisticated social systems, and high trainability in the lab make comparing them an exciting and profitable enterprise. Many of us working with marine mammals have long recognized the potential in such comparisons and, in fact, have adapted for our use both the methodologies and the theoretical models first developed in research on primates. Interestingly, however, most primatologists, who have their own huge literature to grapple with, seem unaware of the progress that has been made in studies of aquatic subjects.

Thus, we decided that the time was ripe for a workshop on comparative cognition, to be held in conjunction with the XVI Biennial Conference on the Biology of Marine Mammals, hosted by The

Society for Marine Mammalogy in December 2005. Focusing on cognition as it functions in the animals' everyday lives, we gathered a set of researchers doing experimental and observational work on primates, cetaceans, and pinnipeds. We hoped that by bringing together primate and marine mammal scientists who shared common interests and were faced with common problems, this workshop could help promote a much needed dialogue between these two groups. Thanks to the editors of *Aquatic Mammals*, we are now able to present a set of papers based on the talks at that workshop that we hope will be a useful resource to all concerned. We still have much to learn from one another, and our science can only be the better for it.

Part I

Part I of this issue is a set of papers that review contemporary cognitive research on primates and marine mammals. These papers aim to provide a rich background on a range of topics of current interest in the field. Each paper adopts a particular perspective on this work, echoing the themes of the workshop such as ecological validity and the complementarity of laboratory and field research. Plus, each paper includes a discussion of the insights that might be gained from past research, as well as suggestions for directing future work.

The first of these, by **Kuczaj & Yeater**, focuses on research on imitation in nonhuman animals in general, and in dolphins in particular. It discusses the variability in types of imitation—such as “kinesthetic,” “symbolic,” and “mindful”—and stresses the need for future investigations into the role of context, development, and individual differences in such imitative processes. It also marks a distinction between elicited and spontaneous imitation, highlighting the impact of task demands and the different roles imitation may play in the ontogeny and social lives of these animals.

Johnson & Karin-D'Arcy review research on social attention in primates, both in the laboratory and in the field. By emphasizing the observed behavior of subjects, in both contexts, over the various theoretical interpretations of those behaviors, this paper aims to facilitate communication between researchers in the laboratory and the field and to promote an ecological view of the laboratory setting. In this view, experiments can be seen as particular types of social interactions, a perspective that may enable us to better understand the pattern of results observed, including their adaptive functions.

Pack & Herman review related research on social attention with cetaceans. Much of this work was fashioned after the experimental work with

primates but includes some ingenious adaptations of those protocols to suit the dolphins' sensory and motor abilities. It also includes a surprising number of findings, such as those on dolphins responding to humans' pointing, that are directly comparable to the results with primates. These parallels underscore the notion of a convergence of skills across these diverse taxa—skills which may reflect their similar levels of social complexity.

Deecke's paper on playback studies conducted with marine mammals in the wild includes research on both cetaceans and pinnipeds. This comprehensive review includes studies whose goals ranged from wildlife management, to ecological assessments, to studies of kin recognition and communication. In the context of this special issue, it becomes apparent that all of these studies offer some insights into the cognitive processes of the animals involved by providing information on their *in situ* discrimination and categorization abilities. This paper also offers a discussion of recent advances in the design and execution of playback studies, as well as suggestions for their further expansion and improvement.

The last paper in Part I, by **Lindemann, Reichmuth-Kastak, & Schusterman**, focuses on auditory learning in pinnipeds as an example of the important complementarities that can arise by integrating field and laboratory research. Field work, for example, provides information on the complex situations in which these animals need to selectively deploy or modify their own vocal output, as well as to learn about the relationships between the vocalizations and correlated visual and olfactory signals produced by other animals. Related laboratory research shows how pinnipeds (like primates, including humans) come to organize such multimodal input into “equivalent classes” that enable them, based on even fragmentary information, to appropriately interpret, predict, and respond to events of consequence.

Part II

Part II of this issue includes papers that focus on innovations, both methodological and theoretical, that have been undertaken in this field. Some report on studies that employ new techniques or nontraditional assumptions, both of which shape the questions being addressed in informative and often surprising ways. Others are more speculative, discussing how recent developments in the way cognition is defined or modeled, as well as advances in technology and analysis, can give researchers access to problems and scientific solutions that were simply not possible with the frameworks and tools of the past. These papers, we hope, will provide prototypes and guidelines

that can help structure the future of comparative cognition, especially with marine mammals.

Flemming, Ratterman, & Thompson report on a pair of studies—one on monkeys and one on human children—in which the subjects were given access to novel tools to obtain out-of-reach rewards. What makes this work distinctive is that rather than testing the subjects in isolation, as is typical in experiments of this kind, these tests were run in a social situation in which the apparatus was simultaneously available to an entire group of subjects. The researchers found, among other things, that subjects' rank predicted their access to the apparatus but not their ability to succeed on the task once they did gain access. Thus, adopting this ecologically valid protocol has revealed that membership in a group may both facilitate an individual's opportunities to discover the functional "affordances" of its environment and inhibit its opportunities to express such knowledge.

Russon's work on foraging in young, free-ranging orangutans used observational sampling of focal animals over several years to track changes in the tactics used by these developing foragers. The progress of their proficiency—from acquiring the essential skills, through exploring elaborations on these techniques, to increasing the efficiency of their performance—reflects not only cognitive developments in the individual but also changes in the "problem space" in which that animal operates. That is, for example, as the orangutans increase in size and strength, both the task variants and the rewards available to them are altered. This approach makes clear that development paces the acquisition of foraging skills and that an animal's repertoire of skill components can be assembled in ways that continue to change over its lifetime.

Fellner, Bauer, & Harley discuss synchrony in dolphins, especially during development, and the possible implications of such coordinated movement for subsequent social learning in these animals. As they point out, the synchronous swimming between mother and calf that begins at birth and continues throughout the early months not only reduces hydrodynamic costs and risk of predation for the infant, but it also may serve to bootstrap the simultaneous imitation of behavior, and later promote the delayed imitation that dolphins have evinced in both the laboratory and the field. While the authors suggest that much additional research is needed on this topic, the apparent importance of synchrony even in adult behavior (in male coalitions, courting pairs, or other displays of challenge and affiliation) indicates that these animals may be both predisposed and well-practiced at reproducing the behavior of others.

Delfour offers a theoretical treatment of the issues raised by the research on mirror-mediated

self-recognition in both primates and marine mammals. She proposes combining an ethological approach with phenomenological inquiry to help develop the concept of "embodied subjectivity"—that is, such a stance takes consciousness as yet another physical phenomenon to be understood, in part, through determining the constraints on the interface between an animal's perceptual perspective, its physical and social environment, and its own learning history. Adopting this stance toward the mirror work leads her to suggest that the controversies that surround its interpretation may arise, in part, from there being many phases of self-consciousness and that these may manifest in different, unexpected ways in different species.

Forster & Rodriguez also propose an innovative theoretical approach, examining the "distributed cognition" that can be observed in triadic (or polyadic) interactions between wild baboons. These authors illustrate how one can treat complex social interactions as dynamical systems, constructing, for example, a "transition matrix" that represents likely trajectories through a "state space" to capture how the system as a whole changes over time. They further advocate exploring such changes at multiple timescales to reveal patterns of coordination and interdependence that occur not just at the level of the individual but between relationships, groups, or other system-level divisions. This sort of hierarchical, dynamic approach helps to maintain a focus on the processes, rather than products, of social cognition.

Finally, **Herzing** describes a similar approach to studying dolphin cognition in the wild, using microethological analyses of audio-video recordings of interactions within a cetacean school. Drawing examples from her long-term studies of spotted and bottlenose dolphins in Bahamian waters, this paper describes potential "media of information flow" through such systems, including vocalizations, gestures, nonvocal acoustics, proximity, synchrony, etc. By proposing a range of behavioral analyses—including frequency tallies; sequential patterns; and multiple, simultaneous time lines at various scales and in various modalities—this approach offers a means of studying cognition, in these or any social species, as it unfolds and functions in the animals' daily lives.

We thank all the contributors for giving us a special issue that we can be proud of! The range and depth of their contributions provide a rich array of pertinent data and critique against which future work can be designed and assessed. We are also particularly grateful to the enthusiastic audience at the workshop. Although, due to many factors, there were even fewer talks on marine mammal

cognition offered at the conference than before, the encouraging numbers and apparent determination of the workshop attendees set on propagating this research were an inspiration to all. Keenly curious and discerning in their questions, they made us believe that the future of comparative cognition on primates and marine mammals can still be bright. Finally, we thank again the editors of *Aquatic Mammals*, Jeanette Thomas and Kathleen Dudzinski, for offering us the opportunity of this special issue and for their support and patience in bringing it together.

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