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# Introduction to the Special Issue

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This special issue is based on a workshop that we organized for the 21st Biennial Conference of the Marine Mammal Society, held in San Francisco in December 2015. That workshop – entitled "Methods for Studying Communication and Social Cognition in Cetaceans" – aimed to provide those interested in pursuing such research with up-to-date information on developments in the experimental paradigms, observational techniques, technological advancements, and data analysis protocols available to conduct such studies.

Research on social cognition includes studies of vocal and gestural communication, as well as tests of the social skills that play a role in learning and problem solving. Such research with nonhumans has been making great strides in recent years, both in the laboratory and the field. Given that cetaceans are reported to be among the most socially complex and cognitively sophisticated species, we hope to draw attention to their potential as research subjects, and foster new studies on these animals.

Work with marine mammals presents many challenges, given their aquatic habitat, their mammalian-atypical vocal and hearing systems, and their long-lasting and often multi-tiered social relationships. Thus, one important aim of the workshop – and of this follow-up special issue - was to address how best to adapt past approaches for future use with cetaceans. This will help us advance our understanding of dolphin communication and social cognition and also provide a basis for interpretable comparisons with the more prevalent work on terrestrial species.

This project seems particularly timely for several reasons. First, recent advances in video and audio recording and analysis put us in a position to collect extensive data, both in the field and in captive settings, like never before. Dealing with massive datasets in a way that makes their analysis both tractable and meaningful, is a problem facing many researchers in contemporary science, and we are thrilled to be able to present some promising solutions in this special issue. Second, interest in cetacean research - as judged, for example, by the record attendance at the Marine Mammal Conference – has never been higher. With the combination of a rich precedence of research with other animals, and new modeling techniques that can accommodate an array of species, the field is poised for us to work together to accomplish exciting new research with cetaceans.

The third factor contributing to the timeliness of this project is, unfortunately, a sad one for those of us familiar with the field. That is, the study of dolphin communication and cognition has suffered significant losses in the past year with the passing of two of its long-term luminaries. Dr. Stan Kuczaj, from the University of Southern Mississippi, who passed away in April of 2016, was a participant in the December workshop, and remains a co-author of one of the papers in this issue. Dr. Kuczaj, whose research includes myriad studies of development, play, social learning, collaboration, and imitation in

dolphins, has played a major role in shaping the field in recent years. His work on personality and individual differences, for example, has helped bring a critical legitimacy to these factors, so important in assessing the abilities and behavior of complex, learning-dependent animals like dolphins. Dr. Louis Herman, who passed away in August 2016, had a long, fruitful career of research on dolphin cognition. Since the 1970s, Dr. Herman's Kewalo Basin Marine Mammal Laboratory at the University of Hawaii generated seminal research on everything from basic perceptual and learning abilities, to artificial language understanding, to imitation and social reasoning. His focus, in recent years, on social cognition issues is just one example of this lab's capacity to stay current, and even lead the way, on the cognitive issues of interest in the field. We would like to express our gratitude to these two ground-breaking researchers for all they have contributed, and dedicate our efforts here to continuing their tradition of inspiring new researchers to build on the foundations they provided.

The six papers in this special issue represent a wide spectrum of approaches to the problems of studying communication and social cognition in dolphins. Some focus on pre-existing research with other animals, including humans, or on the history of related attempts with dolphins. For example, the article by Kuczaj and Lilley, "Out of the mouths of babes: Lessons from research on human infants", reviews experimental and observational approaches used to study pre-linguistic humans, and suggests how these might be profitably adapted for use with cetaceans. Johnson's article, "Exploring social markets, partner debt, and mimetic currency in dolphins", examines what are called "Biological Market" models for studying communication and cooperation across the phyla, from scorpion flies to chimpanzees, and considers how adapting these models for use with dolphins both demands certain modifications and offers insights into new questions that could be addressed in our animals. In "Interfaces and keyboards for human-dolphin communication: What have we learned?", Herzing reviews the long history of research on human-dolphin communication, including contemporary high-tech approaches that make meaningful, two-way exchanges more feasible than ever.

The rest of the papers focus almost exclusively on contemporary developments in technology that open up new vistas of research. Karnowski et al., in "Automated video surveillance for the study of marine mammal behavior and cognition," looks at computer techniques for analyzing huge video datasets and how, in conjunction with trained coders, these can enable us to find systematic patterns in movement and behavior. In "Methods for discovering models of behavior: A case study with wild Atlantic spotted dolphins", Kohlsdolf et al. expand on automated techniques for the analysis of audio, video, and other sensor recordings, and discuss the use of pattern recognition algorithms, like Hidden Markov Models, and other discovery techniques that can support statistical analyses and interpretive visualizations of behavioral patterns in "big data". Finally, in "Whose ~~line~~ sound is it anyway? Identifying the vocalizer on underwater video by localizing with a hydrophone array", Hoffmann-Kuhnt et al. take on the long-standing challenge in dolphin research of identifying which animals are producing which recorded sounds. Long the bane of dolphin communication research, limitations on our ability to identify the "speaker" in a vocal exchange have, to date, held back significant progress on understanding their communication. This paper presents a bright prospect for finally breaking through such limitations, at least for the "click-based" sounds, and make headway on this crucial problem.

In all, we hope that this collection of papers will give readers a better sense of the tools available and the models we can use to make sense of the data that are generated. The authors have provided both practical solutions to current problems in methodological design and implementation, as well as insights from existing research on how these might advance our understanding of communication and social cognition in dolphins. We are grateful to the editors of *Animal Behavior and Cognition* for inviting these contributions and, in doing so, helping to move this field into exciting new realms.