Marine Mammal Science

Memories

MARINE MAMMAL SCIENCE, 26(4): 997–1001 (October 2010)

DOI: 10.1111/j.1748-7692.2010.00415.x

RONALD J. SCHUSTERMAN
(1932–2010)
Honorary Member of the Society for Marine Mammalogy

Ronald J. Schusterman had a passion for living and a passion for science. It is hard to think about the Society for Marine Mammalogy and its beginnings and development without thinking about Ron Schusterman. He was there at every stage and helped bring the Society into being. The Society for Marine Mammalogy arose from the meetings on Biological Sonar and Diving Mammals that were organized primarily by Thomas Poulter of the Stanford Research Institute. Poulter was convinced that sea lions echolocated and he wanted to hire a bright young post-doc to help him prove that. He found Ron Schusterman, recently graduated from Winthrop Kellogg's laboratory at Florida State University. Kellogg had published two very influential papers (Kellogg *et al*. 1953, Kellogg 1958) demonstrating and describing echolocation in *Tursiops,* and Poulter wanted to do the same with *Zalophus*, which is why he brought Ron Schusterman to Stanford Research Institute.

Most people are familiar with the fact that Poulter's plan did not go as he expected. Schusterman, true to the scientific principles that he so strongly believed in, would not be swayed by anything but his data, which ultimately included precise descriptions of sound production and hearing in sea lions. Despite what most people at the time believed, or wanted to believe, he found no evidence that sea lions could echolocate. Even this early in his career, we recall Ron's reliving the stories of his anxiety at the meetings and his necessity to quickly consume nitroglycerine tablets for heart pain as he challenged Poulter's notions of echolocating sea lions, seals, and, even at one point, penguins. Disproving echolocation, or in fact anything in science, is not easy. Essentially, you end up trying to prove the null hypothesis. One of Ron's favorite stories was about meeting a famous colleague in a bar and receiving a free drink and high praise for "being the guy who became famous for proving the null hypothesis." In addition to being a Founding and Honorary member of the Society for Marine Mammalogy, Schusterman was also a Fellow of the Animal Behavior Society, Fellow of the Acoustical Society of America, Fellow of the American Psychological Association, and Fellow of the American Association for the Advancement of Science. He was also recently elected to the California Academy of Sciences.

When one thinks of Ron Schusterman, one readily thinks of his outstanding science and his love of students and teaching. While he was a great marine-mammal scientist, his contributions are much broader than that. He had a beautiful respect for animal cognition and a passionate zeal for finding the most parsimonious answer to the most complex demonstrations of animal brilliance. Throughout his career, he displayed an intimate understanding of animal training that allowed him to probe the basis of complex behavior. His 1967 *Science* article demonstrated how an animal could be trained to switch from a size to a form cue allowing a complete reversal of the discrimination. The experiment began with a triangle being positive and a circle negative, and ended up with a circle being positive and a triangle being negative—all without errors on the sea lion's part. This early demonstration of "errorless" learning contributed to the development of teaching methods for all species—not just sea lions. Ron's subsequent work with arbitrary visual stimuli in laboratory tasks continued to show how simple concepts could result in the explanations of demonstrations of seemingly very complex behavior. His work was greatly respected and published in journals beyond those read primarily by marine mammal scientists.

Matching-to-sample is a task in which an animal examines a "sample" and then examines a group of objects to determine which one matches that sample. Many types of animals can be trained to do this and, in fact, can master the task so well that even when totally new objects are presented the animal may show that it has the "concept" and continues to match to the sample object. The very important question is "what really constitutes a new object?" Schusterman took this research on how animals identify and represent objects one step further by demonstrating that if a group of objects share common relationships, then any one of those objects can serve as the sample for the others on the first trial. A simple parsimonious prior association between objects could be used to explain some very complex cognitive behavior.

This finding was a perfect example of the way Ron Schusterman interacted with the world. He took the idea of "stimulus equivalence" from a person he respected, Murray Sidman, developed it into a working model that explained a complex behavior parsimoniously, worked on it carefully with outstanding students, and spoke to everyone repeatedly until even some of the slower of us understood what he was talking about.

Schusterman's fervent desire to drive towards the most parsimonious explanation in any scientific endeavor led to heated debates regarding the issue of language taught to animals (Gisiner and Schusterman 1989, Herman *et al*. 1994, Herman and Pack 1995, Schusterman and Kastak 1995). While some considered that perhaps apes and dolphins were unique in their artificial language learning abilities, Schusterman and Krieger (1984) and Schusterman (1988) had shown that sea lions were also very competent at artificial-language comprehension and that semantic cognition could be explained by simpler processes (Sidman 1971, Gisiner and Schusterman 1989).

Ron was not only an outstanding cognitive psychologist, he was also a premier psychophysicist and a master of experimental methods. His 1980 paper "Behavioral methodology in echolocation by marine mammals" is about a lot more than echolocation. Psychophysics is all about animals sensing environments and making decisions and the processes that allow experimenters to understand those sensing and decision-making processes. Ron's desire to understand decision making in animals led him to grasp the nuance of signal detection theory. Once again he used it to parsimoniously explain how animal decisions about reporting the presence or absence of environmental events were shaped by the amounts of reinforcement and the probability of occurrence of those events. An animal was much more likely to respond if the payoff was high and if the stimulus event had occurred frequently.

Ron's thought was not at all limited to the laboratory. When he thought of animals, he thought of the whole animal interacting in its natural environment. He used what was learned within the laboratory to explain how animals functioned in the wild. Early on, one of his classic *Science* papers (Schusterman and Dawson 1968) "Barking, dominance and territoriality in male sea lions," demonstrated that large captive male sea lions barked and predictably inhibited the barking of smaller males. This tactic was the same and could be used to explain the establishment and maintenance of territories of wild breeding males in the field. Even Sidman's "stimulus equivalence" model that explained matching-to-sample behavior was used as a model for "How animals classify friends and foes" (Schusterman *et al*. 2000) and to explain the mechanisms that could support the social cognition and intelligence of wild marine mammals and other animals (Schusterman *et al*. 2002). The recognition of conspecifics and the function in wild sea lion society was examined (Schusterman *et al*. 1992) by looking at the recognition of mothers by pups and the recognition of surrogate mothers (human caretakers) as well as long-term bonding of the pups with the caretakers at Sea Life Park Hawaii. This study provided a model of bonding and affiliation primarily intended to be used to examine the mechanisms involved in long-term social structures among related sea lions in the wild (Gisiner and Schusterman 1991).

While Ron was a consummate academic, he was also a vibrant human being with many close friends, outstanding students, and colleagues that mostly seem interwoven with the development and the expansion of the Society for Marine Mammalogy. He was married to his dear wife Francie at the 1999 meeting of the Society in Maui, and he marked many other special milestones in his life with the passing of these meetings since the first conference in 1975. His academic life was celebrated by many at a Festshrift held in his honor covering "Comparative Perspectives on Perception, Cognition, and Behavior" on 25 April 2003. It is certain that a very large number of us will miss his intellectual brilliance and his very special friendship. Ron left not only a lasting and powerful intellectual paper trail, he also left the legacy of a strong and vigorous working laboratory now directed by Colleen Reichmuth at the Long Marine Laboratory at the University of California at Santa Cruz. Colleen Reichmuth continues Ron Schusterman's efforts with the same high intellectual standards and love of science at the Pinniped Cognition and Sensory Systems Laboratory.

Literature Cited

Gisiner, R., and R. J. Schusterman. 1989. Please parse the sentence: Animal cognition in the procrustean bed of linguistics. Psychological Record 39:3–18.

Gisiner, R., and R.J. Schusterman. 1991. California sea lion pups play an active role in reunions with their mothers. Animal Behaviour 41:364–366.

Herman, L. M., A. A. Pack and A. M. Wood. 1994. Bottlenose dolphins can generalize rules and develop abstract concepts. Marine Mammal Science 10:70–80.

Herman, L. M., and A. A. Pack. 1995. Excluding relevant data precludes any analysis. Marine Mammal Science 11:267–270.

Kellogg, W. N., R. Kohler and H. N. Morris. 1953. Porpoise sounds as sonar signals. Science 117:239–243.

Kellogg, W. N. 1958. Echo ranging in the porpoise. Science 128:982–988.

Schusterman, R. J. 1988. Artificial language comprehension in dolphins and sea lions: The essential cognitive skills. Psychological Record 38:311–348.

Schusterman, R. J., and R. G. Dawson. 1968. Barking, dominance and territoriality in male sea lions. Science 160:434–436.

Schusterman, R. J., and K. Krieger. 1984. California sea lions are capable of semantic comprehension. Psychological Record 34:3–23.

Schusterman, R. J., and D. Kastak. 1995. There is no substitute for an experimental analysis of marine mammal cognition. Marine Mammal Science 11:263–267.

Schusterman, R. J., C. J. Reichmuth and D. Kastak. 2000. How animals classify friends and foes. Current Directions in Psychological Science 9:1–6.

Schusterman, R. J., C. Reichmuth Kastak and D. Kastak. 2002. The cognitive sea lion: Meaning and memory in the laboratory and in nature. Pages 217–228 *in* M. Bekoff, C. Allen and G. M. Burghardt, eds. The cognitive animal: Empirical and theoretical perspectives on animal cognition. MIT Press, Cambridge, MA.

Schusterman, R. J., E. Hanggi and R. Gisiner. 1992. Acoustic signaling in mother-pup reunions, interspecies bonding, and affiliation by kinship in California sea lions (*Zalophus californianus*). Pages 533–551 *in* J. A. Thomas, R. A. Kastelein and A. Ya. Supin, eds. Marine mammal sensory systems. Plenum Press, New York, NY.

Sidman, M. 1971. Reading and auditory-visual equivalencies. Journal of Speech and Hearing Research 14:5–13.

Paul E. Nachtigall, Marine Mammal Research Program, Hawaii Institute of Marine Biology University of Hawaii, Kailua, Hawaii 96734, U.S.A.; **Patrick W. Moore**, National Marine Mammal Foundation, San Diego, California 92106, U.S.A.; **Robert Gisiner**, Marine Mammal Branch, Navy Environmental Readiness Division (OPNAV N-45), Arlington, Virginia 22202, U.S.A.; **Colleen Reichmuth**, Institute of Marine Sciences, University of California, Santa Cruz, Santa Cruz, California 95064, U.S.A.