TRAINING SIGNAL DETECTION TASKS FOR DETERMINING SENSORY
THRESHOLDS IN MARINE MAMMALS

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Research in the field of psychophysics often uses signal detection theory to measure an individual’s sensitivity to a stimulus (Stebbins, 1970). While having an animal voluntarily participate in such research understanding of perceptual capabilities and sensory adaptations, the task of training an animal for signal detection presents several challenges. To explore the uniquely specialized sensory systems of amphibious marine mammals, our laboratory has trained basic signal detection tasks in a variety of species, including harbor seals (Phoca vitulina), California sea lions (Zalophus californianus), northern elephant seals (Mirounga angustirostris), Steller sea lions (Eumetopias jubatus), ringed seals (Pusa hispida), spotted seals (Phoca largha), and Southern sea otters (Enhydra lutris).

Many behavioral signal detection tasks rely upon an animal’s voluntary response to a sensory cue. Training for these tasks begins with the shaping of the desired response to a salient stimulus, one that the animal can readily perceive. The “Go/NoGo” method of signal detection involves conditioning an animal to respond when it detects a signal, and to not respond in the absence of a signal (Schusterman, 1980). As training progresses and the animal’s response to the initial stimulus undergoes stimulus control, the signal is gradually altered to promote generalization to similar stimuli, eventually allowing for testing to occur (Stebbins, 1970).

Trainers generally work to set their animals up for success, controlling the learning environment to minimize failure and frustration. In signal detection training, however, allowing animals to make errors is crucial. Errors serve to reveal the limits of performance that define sensory capabilities. Errors also allow the experimenter to gauge the reliability of the animal’s response, and maintain consistency between sessions and with respect to other animals that may also be tested. Through the responses they give to signals near their sensory limits, animals can display response bias by tending towards positively responding to trials without stimuli, or failing to respond to signal trials. An individual’s tendency towards a particular bias may be influenced not only by the individual, but also by species differences or experimental conditions. Through a variety of training examples, we found that creating a problem solving environment where the animal is given less active guidance and allowed to explore the consequences of its own behavior can facilitate a toleration of errors that will aid the animal throughout the signal detection task (Schusterman, 1980).

While presenting many interesting challenges, the training of signal detection tasks utilizes the same principles of operant conditioning as other behavioral training (Stebbins, 1970). By incorporating the principles of signal detection theory we have been able to successfully train individuals of a variety of ages, species, and training backgrounds for signal detection tasks, as well as generalize the established behavior across modalities in order to explore a wide range of perceptual capabilities. Through the cultivation of enriching conditions that encourage decision-making and exploration, we are also provided with insight as to how animals interact with their environment and can learn to modify and adapt their own behavior.

References
