

A STELLER IDENTITY CRISIS?

Brian Lynn, Colleen Reichmuth, and Ronald Schusterman
Long Marine Laboratory, University of California Santa Cruz

Twenty-two years ago, my co-author Ron Schusterman presented a paper at the IMATA conference in Vancouver on filial imprinting in the California sea lion. The purpose my talk today is to review a case study of probable filial imprinting in another otariid pinniped, the Steller sea lion, and to briefly discuss imprinting in the context of sea lion behavioral management.

Filial imprinting can be generally defined as a rapid learning process during early development that leads to a persistent preference of an individual for a definite group of social partners. The best known studies of imprinting were conducted by the Austrian ethologist Konrad Lorenz, whose goslings exhibited strong attachment behavior, including following responses, to his wading boots shortly after hatching. The phenomenon of imprinting has since been extensively studied and described in numerous avian species.

Imprinting in mammals is not well understood. It has primarily been studied in herding or colonial species, including goats, sheep, and sea lions. Such species experience strong selective pressures for accurate mother-offspring recognition, since both mobility and crowding increase the probability of separation. Otariid pinnipeds are especially interesting subjects for studies of attachment behavior, because they breed in high density rookeries, their pups have relatively long periods of maternal dependency, and mother-pup pairs are subject to lengthy separations within days of parturition when females resume foraging (see Reidman, 1990). This reproductive strategy has resulted in rapid and accurate individual recognition between sea lion mothers and their dependent offspring. By the time a female leaves for the first time to forage at sea, her pup has already learned to recognize her call (Charrier et al., 2001). Otariid mother-pup pairs identify and locate each other on the rookery through the exchange of unique stereotyped vocalizations as well as with visual and olfactory cues at close range (Trillmich, 1981; Schusterman et al. 1992). Amazingly, mature otariids have been shown to remember and preferentially respond to playbacks of the calls of their mothers even when tending offspring of their own (Insley, 2000).

The learning process that underlies imprinting has been studied in captive situations where California sea lion pups have been hand-raised by human caretakers (Schusterman, 1992). Twenty juvenile sea lions housed at three different facilities were evaluated. Of these, seven had been separated from their biological mothers within four days of birth. The results demonstrated both generalized human attachment behavior and specific bonding between sea lion pups and the individuals who had served as their original surrogate “mothers.” The following clip shows what Schusterman found to be typical responses of these imprinted juvenile sea lions in the presence of their original surrogates and their current primary trainers.

From this brief background, you can see that imprinting is a specific and durable event. It is not to be confused (although it often is) with other learning processes, such as habituation, sensitization, or classical conditioning.

The subject of my talk today is a young male Steller sea lion named Astro, who arrived at The Marine Mammal Center within a day or two of birth, with his umbilicus fresh and still attached. The Marine Mammal Center had successfully rehabilitated and released at least one Steller pup previously, and took a series of precautions with Astro's care to prevent attachment. Astro was tube fed for a week and then bottle-fed by hand for another seven days. By three weeks of age, he had been fully transitioned to a remote bottle attached to a fence and all staff and volunteers were explicitly instructed not to touch, talk or interact with Astro for the remainder of his time at the Center. He was typically housed with young California sea lions, and for a few weeks, with a juvenile female Steller sea lion. He was weaned off of formula and onto live trout, and in June, he was released for the first time, at Año Nuevo State Reserve. Instead of exploring his environment or joining his conspecifics, Astro tried to remain near people, and then milled about with a group of northern elephant seals for a few days. He was re-rescued and immediately released again off the more remote Farallon Islands, but he swam X miles back to Marin County and began approaching people fishing on the shoreline. When released one final time, again off the Farallon Islands, Astro swam back under the Golden Gate Bridge, into San Francisco Bay and became an unexpected participant in the local "jog-a-thon" on a soccer field full of schoolchildren.

Why was Astro failing to orient to the wild environment and instead choosing to associate with people? Despite all of the precautions, had he irreversibly "bonded" to his human caretakers? Or had he just learned to associate the presence of people with food and comfort? To better understand Astro's situation, we conducted a behavioral evaluation modeled after the earlier captive studies with California sea lions. The evaluation consisted of three components: a stationary preference test, a following test, and an acoustic playback test. Astro was 12 months old at the time of testing, and was fed prior to these assessments to control for the confounding effects of food motivation. Our assessment involved four Marine Mammal Center workers – two original surrogate mothers who cared for Astro during his first three weeks at the Center and two familiar controls who began working around him some months later.

The preference test was comprised of several trials where two caretakers sat on opposite sides of the enclosure, allowing Astro to initiate contact while they remained unresponsive, only moving to change positions every two minutes. Preference was measured as a function of percent time in direct contact with a person. As you will see in this clip, responses typical of Astro during this test included rubbing, nuzzling, sniffing, gentle biting and suckling on skin and clothing. Astro did not show a preference for any one individual, and instead showed a strong preference for association with people in general that did not abate with repeated exposure in the absence of food or attention.

Next, we instructed the four workers to continuously walk around Astro's enclosure during separate two minute intervals. When these trials began, Astro was nearly always in the water, likely a result of the contingencies the Marine Mammal Center had established during feeding. Though Astro did follow his caretakers for a significant amount of time, he was not always in close contact with them. He frequently protested the movement of his caretakers, and attempted to slow them by lunging over the side of the pool or throwing himself beneath their feet. Even when he tired of following his caretakers, Astro continuously oriented to their movements.

The acoustic playback experiment aimed a speaker at Astro's pen from outside the fence and presented him with 30 seconds of playback followed by 60 seconds of silence repeated for each of the four workers' vocalizations. Each four-trial test was repeated four times over a period of two hours, totaling 16 trials, with the order of the playbacks randomized in each test. Similar to a pup trying to locate its mother on a crowded beach, Astro initially oriented, approached and vocalized toward the speaker for each of the initial set playbacks. However, during the remaining three tests, only the vocalization of an original caretaker, one of the few to bottle-feed him by hand, continued to elicit a strong response in a paired call and response pattern.

In order to verify that his responses were not typical of other sea lions, two same-aged California sea lions were evaluated as controls. During select trials of the following and acoustic playback tests, these animals were present in the same enclosure and responded with a short-lived curiosity, either orienting to a person walking into the enclosure or to a speaker playing a loud, novel sound, then returning to swimming and interacting with each other in the pool. Astro ignored these individuals and consistently chose to engage the human stimuli in his environment for as long as they were present.

Similar to imprinted California sea lions, Astro exhibits a heightened and persistent interest in humans and a decreased interest in conspecifics, suggesting that he is imprinted and prefers humans as his social partners. Even with careful handling and limited contact, imprinting can still occur. Due to the critical role of timing, this phenomenon does not occur in animals hand reared during later stages of development. The long-term effects of imprinting in pinnipeds remain poorly studied, but may include both aggressive and affiliative species-typical behavior directed at people. For now, Astro continues to be an eager, inquisitive, focused animal that will thrive on human interaction in a structured and challenging training program.