THE ROLE OF RECORDED DATA IN ACCLIMATIZING A HARBOUR PORPOISE (*PHOCOENA PHOCOENA*)

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In March of 1976, the aquarium's veterinarian brought a young female harbor porpoise to the aquarium and housed her in a shallow (60 cm) portable pool. The animal had stranded herself on a nearby beach. The animal was about 8 months old judging from her length (99 cm) and weight (27 kg) (Smith & Gaskin, 1974).Her breathing was rapid and shallow. She frequently listed to one side and repeatedly bumped her rostrum on the sides of the pool. Blood samples showed an elevated white cell count, but no infectious agent was identified. She was injected with broad-spectrum anti-biotics, tube-fed a blended mixture of squid, herring, and vitamins, and observed for the rest of the day.

The next morning she received another dose of anti-biotics and another tube feeding. She still listed and bumped the sides of the pool, but less frequently than before. In the afternoon she was force-fed 1,5 kg of small herrings, most of which she regurgitated. That evening she was carried upstairs and placed in a large, chlorinated (1 to 3 PPM) pool, 7.30 m in diameter and 3.00 m deep.

Responsibility for the animal was transferred to the training department, which began collecting the data reported here.

Feeding

Table I gives details of feeding from the time the animal was moved to the training department until she was feeding routinely from our hands. After showing no interest in squid during the first 22 hours, she approached with in 1.5 m the first time a herring was wiggled in the water. The fish was withdrawm and presented again in 5 minutes. Again, she approached within 1.5 m. The next fish was released to float to the bottom. She investigated closely, but did not touch it. The next morning she hovered about 1.5 m away as we fed her *Tursiops* companion, but ignored the squid we let drop to the bottom. Had we been aware of consistent reports that the bulk of *Phocoena's* diet comes frome Clupidae, Gadidae, and Scombridae (Smit & Gaskin, 1974; Dudok van Heel, 1962; Andersen, 1976; Rae, 1966), we might have speeded the transition to dead food by offering herring or mackerel from the beginning.

By noon of the third day she would approach a herring held in the water, but veered away when her *Tursiops* companion moved in to take it. None of our three *Tursiops* has shown any willingness to share food with *Phocoena*.

In the afternoon, with *Tursiops* absent, she retrieved a capelin (*Mallotus villosus*) from the bottom and briefly mouthed it before letting it drop to the bottom. Two hours later she mouthed another capelin on its way to the bottom. At 5.30 P.M., 72 hours since her last tube feeding, she ate two live Mummichaugs (*Fundulus heteroclitus*) whose tails had been mutilated

TABLE I

Food intake of a juvenile **Phocoena phocoena** from the time of capture to routine hand-feeding

Time since captivity	No. of meals	Size of meals, kg	Kind of food	Method of feeding
1st day	1	0.9	blended herring and squid	tube
2nd day	1 1	0.9 1.4	as before whole herring	tube forced
3rd day 4th day 5th day	Refused mackerel, herring, and squid when offered by hand or when dropped in the water			
6th day	1	0.2	live Mummichaugs	Multilate tails released into pool
7th day	3	0.2	thawed capelin	by hand
8th day	3	0.2	,, ,,	by hand
9th day	6	0.3	,, ,,	by hand
10th, 11th	6	0.3	,, ,,	by hand
12th-40th	5	0.5	thawed capelin, mackerel, and herring	by hand
40th-present	3 to 4	0.9-1.4	thawed capelin, mackerel, and herring	by hand

for easy capture. Within the next hour she ate 15 more, taking most of them from the rear, a predatory style which Smith and Gaskin (1974) suggested may be typical for *Phocoena*.

While eating the Mummichaugs, she would hover within 15 cm of the feeding station until the trainer released a fish. Habituation to our presence, at least under 72 hours of deprivation, was well along. All together, she ate 30 Mummichaugs in an hour, but their combined bulk was only a fraction of the 3-3.5 kg of fish which an animal of her size is thought to require (Smith and Gaskin, 1974). Unwittingly, we may have postponed the transition to eating thawed fish by feeding live prey. The following note indicates a lack of interest in food fish that do not move: ,,She continues to come to food station for live Mummis, but makes only 1 or 2 passes to a stunned one, then ignores it completely." Andersen (1976) also warned that feeding live fisch may postpone the transition to thawed fish. At noon on the following day she followed a thawed capelin to the bottom of the pool and ate it. She ate capelin all the rest of that afternoon, taking some from the bottom and others from a trainer's hand. Although the fish were dead, she made jerky motions of her head several times after taking the fish in her mouth. It is likely that these were killing bites normally made to live prey. This response was not observed after the second day of hand feeding. While she was eating the capelin, several of us stroked her sides lightly as she swam by to take a fish. Thus, the 7th day since capture marked the beginning of routine hand feeding and of tolerance to human touch.

The animal's fear of humans was clearly a variable that helped determine when she would eat thawed fish. Fear of humans, in turn, is related to the capture technique and the subsequent behavior of humans towards the captive animal (Dudok van Heel, 1962). As other authors have reported (Dudok van Heel, 1962; Busnel & Dziedzic, 1966; Andersen, 1976), the transition to hand feeding in *Phocoena* was accomplished within the first 5 days, not counting the 2 days during which the animal appeared to be ill. During those two days, she was frequently restrained for innoculation of anti-biotics and for tube-feeding.

At this writing, she weighs 41.4 kg a weight gain of 35% in 10 months. Her daily ration is 4.5 kg of mackerel, herring and capelin. This is equal to 10.8% of body weight, which Andersen (qouted by Smith and Gaskin, 1974) gave as the average daily consumption of wild adults. 4.5 Kg a day may be too much food, since our 18-month-old female already weighs as much as an average wild adult (Dudok van Heel, 1962; Fisher & Harrison, 1970; Gaskin, Arnold, & Blair, 1974). Captive *Phocoena* expend less energy finding food and avoiding enemies. In addition, our animal loses less body heat to the water in her 19°C pool than her wild counterparts lose to the much colder waters of the north Atlantic.

Relationship with Tursiops

On the third morning after capture and 13 hours after our *Phocoena* had been transferred to the training department, the mildest of our two female *Tursiops,* a 5-year old non-parcous animal named Sandy, was given the opportunity to join her. As the gate separating the two animls was lowered, Sandy sped into *Phocoena's* pool and began swimming fast circles near the surface. Simultaneously, *Phocoena* swam fast circles near the bottom. Our notes for the next few minutes follow:

7:00 A.M. Sandy into holding pool. Circles on top. *Phocoena* circles bottom.

7:02 Sandy approaches trainer for morning feeding. Eats 0.5 kg capelin. Resumes fast swimming.

7:06 Sandy approaches *Phocoena* on bottom of pool. *Phocoena* immediately falls into line at Sandy's dorsal and the pair circle rapidly with Sandy interposed between us and *Phocoena.*

7:15 Sandy reverses direction. *Phocoena* breaks away to swim alone.

7:16 Pair rejoins. *Phocoena* again at Sandy's dorsal. Sandy between us and *Phocoena.*

7:18 *Phocoena* breaks away, swims one circle, re-joins Sandy. Breaks away again. Rejoins Sandy. Male *Tursiops* hovering at gate.

7:22 Swimming side by side, slower than at first.

From 7:15 to 7:25, the pair rose 27 times to breathe in unison and the average length of a breath was 22 seconds. From 7:30 to 8:00, the animals breathed 85 times in unison, holding the breath an average of 21 seconds. Sandy's behavoir is exactly what McBride & Hebb (1948), Tavolga & Essapian (1957), and Clugston (1974) described as maternal behavior. *Phocoena's* position at Sandy's dorsal fin is typical for that species as described by Neave and Wright (1968) for wild *Phocoena*. Thus, both animals collaborated in the relationship.

In view of Andersen's (1976) observation that a newly introduced animal may adopt a swim pattern similar to one used by another animal already in the pool, and the fact that Sandy is nonparous, one might wonder whether the two animals were simply swimming the same pattern without being much aware of one another. However, as Tavolga (1966) noted: ,,A nonparous animal may show certain types of maternal behavior:" Moreover, Caldwell and Caldwell (1966) described the adoption of a young *Tursiops* by two older females. Even without this confirming evidence, however, the complete synchrony in swim pattern and breathing, *Phocoena's* position at Sandy's dorsal fin, and the following observations remove any doubt that we had witnessed a genuine case of cross-fostering:

8:17 A.M. Sandy positions her genital slit on *Phocoena* pec and dorsal.

8:23 Sandy bumps *Phocoena* with her dorsal and animals switch positions relative to wall of pool. *Phocoena* still in infant position. 5 laps and *Phocoena* then switches to Sandy's other side. 2 laps, then *Phocoena* switches position again.

10:20 Sandy nudges *Phocoena* genital slit with dorsal fin.

12:50 Sandy pursuing *Phocoena* around pool. Both swimming fast.

The two were separated for the night and re-united in the morning. Sandy swam quickly into the holding pool and *Phocoena* fell into position with her rostrum just forward of Sandy's dorsal. During the next half-hour, we again observed chasing, mutual genital stimulation, and frequent shifts in direction. In addition, we saw the two cooperate in another response that is typical of a *Tursiops* mother with her young: Sandy swam on her back, using her pecs to hold *Phocoena* close to her belly.

Nursing was the only element missing from the repetoire of mother-infant behavior. The fact that *Phocoena* was past the nursing stage (Slijper, 1962, gives 6 to 8 months as the weaning period) and that Sandy is nonparous are sufficient to explain the absence of this response. Our other female *Tursiops* spent a lot of time hovering at the gate to the holding pool where Sandy and *Phocoena* were housed. By the 4th day of their relationship, Sandy showed some reluctance to join *Phocoena* and the other female, Sassy, rushed to take Sandy's place. Sassy swam directly towards *Phocoena,* which swam away. Sassy pursued and *Phocoena* then took up the infant position at Sassy's dorsal fin. The pair breathed in unison from the start and several switches of direction occurred in perfect synchrony as they swam fairly rapid circles around the pool. As with Sandy, Sassy interposed herself between us and *Phocoena.* Within the first hour, we observed *Phocoena* swimming across Sassy's dorsal fin, swimming directly at Sassy who veered just before a collision would have occurred, and coasting next to Sassy's dorsal fin while the latter propelled both of them with steady beats of her flukes. Sassy twice rubbed her rostrum on *Phocoena's* belly, chased *Phocoena* whenever she left Sassy's side, and, when a diver entered the pool, interposed herself between *Phocoena* and the diver.

Although the same age as Sandy, and also nonparous, Sassy was decisively dominant over Sandy. On the following two mornings, Sassy was first to enter *Phocoena's* pool and immediately collected *Phocoena* in the mother-infant position. No new responses were seen. After 3 days with *Phocoena,* Sassy's interest waned and she allowed Sandy to enter *Phocoena's* pool on the 4th morning after Sandy had been displaced. On the following morning, both female *Tursiops* entered *Phocoena's* pool, but Sassy asserted her dominance by interposing herself between *Phocoena* and Sandy. *Phocoena* accepted this state of affairs and lined up next to Sassy's dorsal fin on the side away from Sandy. Attempts by Sandy to swim next to *Phocoena* caused Sassy and *Phocoena* to suddenly reverse their direction.

A half-hour later, Sassy began striking Sandy with her flukes. Sandy left *Phocoena's* pool as soon as we dropped the gate.

Some eight months later, very little remained of the mother-infant relationship between *Phocoena* and either female *Tursiops*. *Phonoena* no longer swims in the infant position and the female *Tursiops* do not interfere when *Phocoena* interacts with the male *Tursiops*.

But a relationship still exists between Sassy, at least, and *Phocoena*, as the following protocol shows. ,,*Phocoena* beached herself and could not get back into the pool. We came out and found Sassy repeatedly beaching herself, giving *Phocoena* a nudge each time. When we put *Phocoena* back into her pool, she and Sassy swam fast circles together with their eyes closed." Sassy's behavior in this situation seems a clear example of epimeletic or care-giving behavior (Caldwell & Caldwell, 1966).

Breathing

When our animal breathes, the sequence of body movements is exactly as Amundin (1974) described them. The melon is visible first as she begins the sequence and the caudal peduncle is seen last as she submerges. The pectoral fins and flukes remain submerged throughout the roll. Besides the surface roll, the animal occasionally breathes by poking her head above the surface just far enough to clear the blowhole. McBride and Kritzler (1951) reported a similar breathing technique for *Tursiops truncatus* up to the age of about 2 months and Amundin (1974) observed a juvenile *Phocoena* employing both the roll and the head-up method. External factors may determine which method an animal uses. Our *Phocoena* can get no further than 7.30 m from us, since that is the diameter of her pool. Poking her head above the surface to breathe exposes less of her body than the surface roll. She may also be able to see us better in the head-up orientation. Several authors (Parker, 1932; Andersen, 1976) reported that *Phocoena* breathes about 4 times a minute, a rate consistent with the bulk of the data in Table II. The same authors noted that *Phocoena* may retain a breath for up to 90 seconds if frightened and up to 3 minutes if diving for food (Gaskin, Smih, & Watson, 1975). The longest breath interval we recorded was 87 seconds, the shortest less than 1 second. The average interval from one inhalation to the next varied from 8 seconds to 38 seconds.

The last column of Table II shows the number of breath intervals that were less than 5 seconds in duration. These are the rapid inhalations followed by loud forceful exhalations which Parker (1932) and Gaskin *et al* (1975) reported. They occur when the animal has been under water longer than usual. It may be thought that these short breaths inflate the variability of a breath sample, but this is not so. Standard deviations of the first 5 samples were calculated a second time with breaths less than 5 seconds deleted from the samples. The results were practically identical to those given in the table.

TABLE II

Breath cycles of a captive **Phocoena phocoena**

Sample	Date	Time	No. of cycles	Average length of cycles (seconds)	Standard deviation (seconds)	Coefficient of variation (percentage)	Breaths less than 5 sec.
1	3/25/76	6.00 P	18	20.1	17.9	89	4
2		6:15 P	12	12.6	11.1	88	4
3		6:20 P	12	18.5	16.7	90	3
4		6:45 P	14	20.1	17.0	84	4
5		6:55 P	12	20.8	19.3	93	5
6		7:20 P	17	17.5	15.7	90	4
7		7:40 P	16	24.6	20.9	85	4
8		8:05 P	13	21.5	13.7	64	1
9		8:16 P	21	15.9	8.4	53	1
10		8:30 P	18	20.1	17.9	84	4
11		8:40 P	16	20.9	17.1	82	3
12		8:50 P	23	14.9	9.6	64	1
13		9:00 P	41	14.4	7.4	51	2
14		9:15 P	53	15.5	9.3	60	5
15	3/26/76	12:45 A	15	14.4	2.9	20	6
16		2:50 A	10	24.2	14.3	59	1
17		3:40 A	13	19.1	23.6	123	4
18		6:50 A	10	20.4	22.3	109	6
*19		7:05 A	8	38.4	17.9	47	0
*20		11:20 A	16	13.2	6.3	48	1
*21		12:20 P	12	21.2	12.1	57	0
*22		2:15 P	13	15.7	5.1	32	0
23		3:45 P	13	26.7	20.4	76	1
*24		4:17 P	13	17.3	6.1	35	1
*25	3/27/76	9:30 A	20	13.5	6.2	46	2
26		11:20 A	14	22.7	8.1	36	0
+27	3/28/76	8:45 A	14	17.6	8.3	47	0
+28	3/29/76	9:10 A	19	19.7	11.3	57	0
29		3:45 P	15	18.4	13.3	72	1
30	3/31/76	9:40 A	22	15.0	9.1	61	4
+31		2:35 P	18	18.2	10.0	55	2
*32	4/1/76	3:50 P	15	7.2	3.5	49	5
+33	4/5/76	9:45 A	15	15.0	8.7	58	0
34	4/12/76	1:40 P	13	18.5	7.7	42	0
+35	1/25/77	1:30 P	16	10.0	5.7	57	0
36		3:00 P	21	8.8	6.0	68	0

Note: * to the left of a sample number indicates that Sandy, one of our female **Tursiops**, was with **Phocoena** when the sample was taken.

+ indicates that Sassy, the other female **Tursiops**, was present.

Quantitative measures of habituation are helpful in delineating the various stages which an animal passes through when it is adjusting to a new environment (Hinde, 1966). They are also useful in making husbandry decisions. Noting the steady decline in the variability of the animal's breath cycles, we felt confident that the first stage of habituation was proceeding normally. Consequently, we decided against force-feeding. The less an animal is restrained, the sooner cumulative food deprivation prepares the animal for the shift to thawed fish. The more an animal is restrained, the more the presence of humans is associated with stress, the slower the pace of habituation, and the longer it takes to accomplish voluntary feeding. During the first 12 hours, covered by samples 1 through 18, the course of habituation is marked by fairly stable sample means and progressively smaller standard deviations. There are exceptions to this trend, as in samples 17 and 18, but the high variability of these samples is a combination of small sample size and one or two long breaths. In sample 17, for example, a single breath of 83 seconds markedly increased the standard deviation. There is nothing in our notes to indicate the reason for these occasional long breaths. In sample 19, however, the reason for the greatly elevated sample mean is known. This sample was taken as one our female *Tursiops* was put with *Phocoena* for the first time. As *Tursiops* entered *Phocoena's* pool, the latter's first few breaths were much longer than usual.

After that initial encounter with *Tursiops,* a marked reduction in variability can be seen. At first, as in samples 20 to 22, the shift to less variable breath cycles is attributable to breathing in synchrony with *Tursiops.* In sample 23, when *Phocoena* was again alone, the standard deviation increased significantly ($P< 001$, $t=-6.83$, $df=11$) over the previous sample. There was a corresponding, but less significant ($P<.10$, $t=2.05$, $df=12$) increase in the mean of sample 23. When *Tursiops* rejoined *Phocoena* thirty minutes later (sample 24), the drop in variability was again significant ($P<.001$, $t= -5.16$, $df=11$), but the corresponding decrease in the mean was not ($P>.10$, $t=1.57$, $df=12$).

The effect attributable to synchronous breathing with *Tursiops* was short-lived. After sample 24, the standard deviations of the sample are low whether a *Tursiops* is present or not. Even when the second of our two female *Tursiops* was put with *Phocoena* for the first time (sample 27), there is practically no change in the standard deviation from the preceeding sample. Later, in sample 29, when this *Tursiops* was removed, leaving *Phocoena* alone, there is again very little change in the variability of *Phocoena's* breath cycles. Six days after we received this animal (from sample 32 onward), a modest but permanent reduction in the average length of a breath is noticeable. The mean was 15 seconds or longer in 84% of the samples up to sample 32. Thereafter, the mean was less than 15 seconds in 57% of the samples. This effect persists as of this writing.

Shorter breaths reflect, on the one hand, a reduced fear of exposing herself at the surface and, on the other, a learned tendency to remain at the surface. As a learned response, 'remaining at the surface' is a function of our interactions with the animal. Our approaches to her pool were quite variable in time and the proportion of approaches that resulted in food or attention to the animal were also variable. 'Remaining at the surface' was, therefore, being reinforced on a combined variable-interval, variable-ratio schedule. Both these schedules are known to produce persistence of behavior (Ferster & Skinner, 1957).

Training

A regular pattern of food intake and habituation[1] to the presence of humans are prerequisite to the sort of training methods usually employed with performing cetaceans and pinnipeds. Habituation to humans is not required if training is done some distance from the animal, but training from a distance is anathema to marine mammal trainers, in spite of its greater effectiveness[2]. Consequently, we did our work standing or kneeling next to the edge of the animal's pool.

One of the first steps was to pair the 'click' made by a metal cricket with each piece of food. The trainer held one clicker in the air and another in the water, so that the sound would reach the animal in either medium. Within a week, the clicker had become a discriminative stimulus (S^D) for approaching the trainer and an effective conditioned reinforcer (which trainers call a bridge stimulus) for other behavior which we wanted to shape. The unconditioned reinforcer[3] was a piece of cut herring or mackerel.

The principal tool used in training this animal was the target pole. It is a length of bamboo with a rubber donut fastened to one end. Whenever she touched the rubber donut with her rostrum, she received both a conditioned and an unconditioned reinforcer, in that order. Within 10 training sessions (sessions lasted between 10 and 20 minutes), two responses were under stimulus control: approaching the trainer and touching her rostrum to a ball that was taped to the end of the target pole.

Touching things with the rostrum defines a broad response class. She quickly generalized to other members of the class, including any familiar object held in the hand or floating on the pool, and the trainer's face (when held over the pool). The Brelands' (1966) comments concerning the ability of cetaceans to generalize may be pertinent to the ease with which our animal learned this group of responses.

Another response class that began occurring at this time was leaping. There were 3 variants: going straight up in a plane perpendicular to the water, then falling back in the same plane; going straight up and falling on her side (which is topographically identical to a breach); making an arching trajectory similar to the ,,porpoising" of *Tursiops*. These responses are almost certainly artifacts of captivity, since field workers (Scheffer & Slipp, 1948; Dudok van Heel, 1962) report that *Phocoena* does not leap clear of the water.

The initial occurrence of leaping may have been the result of synchronous swimming with *Tursiops* as wel as observering *Tursiops* performing various types of jump in the shows. But imitation learning is a difficult phenomenon to document (Myers, 1970; Thorpe, 1951) and we lack the data to make a case for it.

The subsequent occurrence of the leaps is partly attributable to the effect of the conditioned reinforcer, which was intermittently applied to them as they occured, and partly attributable to other variables which we have not been able to identify.

Slapping the flukes on the water also occurred early in training. The origin of this behavior may be instinctive. Andersen (1976) described it as a form of aggression and we noted it on several occasions when the animal's responses did not meet our criteria and, consequently, were not reinforced. Withholding reward frequently results in increased vigour of on-going behavior (Ferster & Skinner, 1957, p. 57 ff) and in specific aggressive responses (Hinde, 1966,

p. 289 ff). Both effects were observed when reinforcement was withheld. Fast, erratic swimming exemplified the general effect of increased vigour of behavior and slapping the flukes (in one instance across the trainer's face) exemplified a specific aggressive response.

Owing to its occasional reinforcement, slapping the flukes began to occur as an operant. As its frequency increased, it was combined with a ball in the water to produce the composite response of hitting a ball with the flukes.

The next response that we wanted to teach was leaping over a hurdle held above the water. The first step was to teach the animal to swim over a hurdle placed in the water. We learned, as Andersen (1976) did, that elongated objects in the water require more habituation than other kinds of objects. It took 13 training sessions spread over a month's time before the animal stopped shying from a bamboo pole held in the water. Habituation may have taken less time had the pole been left in the water continuously, until habituation was complete.

Up to this point, 10 responses had been brought under fairly reliable stimulus control in about 50 15-minute sessions spread over 8 months. Another 3 months passed in which the animal had daily practice with this repertoire.

At this writing, the animal is learning 5 new responses: a succession of arching leaps (like the porpoising of the larger delhinids), turning on her vertical axis in the water, breaching on cue, jumping trhough a hoop, and moving backwards while holding herself upright on her flukes (commonly called 'tailwalking').

Again, the target pole is the principal training prop. Having long ago taught the animal to touch the tip of the pole, the trainer now describes with the pole the motion that is wanted from the animal. As the animal follows the pole, she inadvertently goes through the desired motion. By using a conditioned reinforcer to end the motion, and by gradually super-imposing a visible hand signal (an S^D) on the moving pole, the animal is learning to emit the new responses as discrete behavioral units.

The worst of our training problems arose in attempting to bring each response under the control of its own S^D. The most effective remedy which we employed was the Time-Out (T.O.). This involved walking away from the animal when she refused to respond to an S^D or when she gave the wrong response [4]. Long lay-offs from training also appeared to act as T.O.'s. The training notes invariably record excellent progress when training resumed after a 3 or 4 day lay-off. A final note concerns the classic mistake of reinforcing a false chain. As this training error befalls scientist and trainer alike, an example seems warranted.

Early in training, when the animal was learning to swim over the target pole, she balked on one occasion and bit the pole instead. The trainer immediately withdrew the pole and held a ball over the water. Within a few seconds, the animal had touched the ball and been reinforced. That particular reinforcement strengthened not only 'touching the ball', but also 'biting the pole'. The result was that both responses occurred for a time, one after another, in a false 2-component chain.

An example from the scientific literature, which the author himself became aware of, is in Dudok van Heel's (1962) report on directional hearing in *Phocoena.* The animal was trained to approach one of two transducers to indicate the source of an auditory stimulus. Near threshold values the animal adopted the habit of swimming first to the transducer on its left. If reinforcement was not forthcoming there, it would swim to the other transducer which, of course, had to be correct. Thus, it learned to check in at both transducers instead of discriminating the one which had produced the test stimulus.

Amundin's plea (1974) for everyone involved in behavioral work with cetaceans to use a standard terminology should perhaps be supplemented by the reminder that everyone will also have to use standard procedures for training their animals. Until that happens, the many comparative questions which interest us all will remain moot.

Notes

1. We adhere to the loosely observed convention that 'habituation' designates a gradual adjustment to a complex set of stimuli.

2. The advantage of presenting stimuli and delivering consequences from a distance, by means of electronic or mechanical gear, is greater consistency in the information provided to the animal. At the same time, there is less tendency to anthropomorphize. Nevertheless, the senior author knows of no case in which the scientific approach to training has meshed smoothly with the traditions of the self-taught marine mammal trainer. Amundin (1974) mentioned a different aspect of the same problem.

   The conflict between the two approaches may underly some of the reader's questions as he proceeds through this section. Notice that, for example, a fixed ratio of 1 reward for every second response (FR 2) is the only alternative we ever employed to a schedule of continuous reinforcement (CRF).
3. For the definition of technical terms, see the glossary in Ferster, C.B. and B.F. Skinner, 1957.
4. Some authorities (e.g. Ray, 1966, p. 671) fear that Time-Outs may stress an animal unduly. The degree of stress produced by a Time-Out is not solely a function of how often it is used, but of other variables as well.

Of particular importance is the schedule of reinforcement which the animal is accustomed to, also the use of several kinds of punishment in sequence. If, for example, a trainer asks an animal to repeat a response several times in succession without reinforcing it (which is one kind of punishment for the animal accustomed to a reward after every behavior) and then, in addition, applies a long Time-Out (which is a second kind of punishment), the animal may be unduly stressed.

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