A feed delivery system for the study of choice behavior in cows

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A feed delivery system for the study of choice behavior in cows is described. Supportive data are provided for six dairy cows exposed to two-alternative, concurrent variable-interval schedules.

Although many feed delivery systems are commercially available for the presentation of reinforcers to small laboratory animals, groups working with larger animals have been forced to develop their own. Commonly, these have delivered a quantity of feed into a fixed trough in the experimental chamber (Meyers & Mesker, 1960; Whittlestone, Mullord, Cate, & Waite, 1975).

Sandler, Van Gelder, Karas, and Buck (1971) built a device for presenting sheep with feed in a hopper that rotated toward and away from the subject. Unfortunately, cows keep their mouths on a food tray as it moves (Krushinskii, 1962) and any device that folds back into a cavity is likely to result in a pinched nose on the cow or a dented tray on the feeder.

The study of feed preferences in dairy cows through the concurrent scheduling of differing foodstuffs is of practical importance, since a multitude of commercial feeds of known composition are available, as well as many "home-brew" silage types and mineral licks. Many of these, particularly grass-based feeds such as hay and silage, pose problems for automated delivery systems because of varying density of self-adhesiveness. It was decided, therefore, to build a double feeder capable of offering different reinforcers in solid, granular, or liquid form.

In this system food is presented at one of two access openings. Both stay open while a feed container is brought up to one for a programmed interval. The availability of the reinforcer is signaled with a buzzer. It is known that access to feed for a fixed period has better stimulus control properties (Ferster & Skinner, 1957) and is generally "cleaner" than the delivery of an amount of feed: Cows working on short fixed-ratio schedules have been seen to amass three or four reinforcements before eating them.

The apparatus (Figure 1) has an angle-iron box frame 920 x 450 x 800 mm high. Front and side panels are covered with 24-gauge galvanized iron sheet. Attached to the front edge of the frame, through steel hoops with midpoints 450 mm apart, are two rolled, galvanized sheet (26-gauge) cylinders of 310-mm diam and 600 mm high. Two plastic buckets, cut down to 250-cm depth and 310-mm diam, slide into the cylinders.

Figure 1. Feed delivery apparatus.

Attached to the base of each bucket is a right-angle bracket connected to a compressed air cylinder (300-mm stroke and 38-mm bore, 3Kp/cm², SD = 15001/12/S.S./RC Kenny) mounted on a central upright support to the frame. The bracket bears on the upright by means of a roller.

Figure 2. Air cylinders and circuit for pneumatic feeder.

The cylinders (Figure 2) are driven through two five-port solenoid-operated spring-return valves (24 V ac), S.41/ES Kenny). Stroke speed of the cylinders is adjusted via their air exhausts.

The frame has a hardboard top with two circular, 250-mm-diam access hole cut over the feed buckets.

The apparatus is secured to the pen wall by a bracket and drop-in pin.

The operanda are two spring-loaded, polyvinyl chloride plates 100 x 100 x 5 mm mounted on the hardboard top at an angle of 30 deg. When pressed, the plates close electrical microswitches (Bulgin S725). The two operanda are 680 mm apart; subjects have

shown predictable and replicable concurrent-schedule performance when both qualities (Figure 3) and rates of the reinforcer(s) have been varied.

Six dairy cows were exposed to two-alternative, concurrent, variable-interval (VI) schedules (concurrent VI 60 sec VI 60 sec), with dairy meal as the reinforcer on one plate and barley as the reinforcer on the other. In this way both a ground and a pelleted meal were independently compared with barley. The ratio of the number of responses on the dairy meal plate to the number of responses on the barley plate (preference ratio) was calculated for each animal on both comparisons. The ratios of time spent responding on the respective plates were also obtained. For individual animals, the ratios for the pelleted dairy meal vs. barley were almost always larger than for the ground meal vs. barley (Figure 3). Hence, pelleted meal is preferred to ground meal. It is also noted that, since few ratios were greater than 1.0, barley was generally preferred to either meal.

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Figure 3. The ratios of the number of responses and time spent responding on each alternative under the concurrent-schedule procedure when each of two different dairy meals was paired with barley. The ratios were taken to the dairy meal alternative (dairy meal performance measure divided by barley measure). The individual cow and group (average of all six cows) data are shown.

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