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Cultural Transmission Without Imitation: Milk Bottle Opening by Birds

The spread among British tits (Paridae) of the habit of opening milk bottles was interpreted by Fisher & Hinde (1949) as having been initiated independently by a small number of birds and acquired by the majority of others as the result of interaction with milk-bottle-opening individuals. The wording both of the classic Fisher & Hinde (1949) paper and a later note (Hinde & Fisher 1972) is, however, appropriately cautious in discussing the behavioural processes responsible for the propagation of the habit of milk-bottle opening. The authors suggest both social and non-social reasons for its spread. Secondary sources are frequently less hesitant to attribute the spread of milk-bottle opening to learning by observation or imitation (Marler 1972; Manning 1979; Wallace 1979; Bonner 1980; Wittenberger 1981). As Fisher & Hinde (1949) stated, resolution of the question of the mechanism by which the behaviour is acquired can only be answered by 'carefully controlled experiments on birds of known history' (page 347).

It seemed to us that the presence in an area of milk-bottle-opening birds provides naive birds not only with potential models of opening behaviour, but also with access to open milk bottles from which they could feed. Either factor might produce milk-bottle opening in naive individuals. The present report describes a laboratory study of the role of exposure either to trained birds or to previously opened milk bottles in facilitating the acquisition of milk-bottle opening by naive chickadees.

Sixteen black-capped chickadees (*Parus atricapillus*) caught as adults on the Erindale campus of the University of Toronto served as subjects. During the experiment, subjects were permitted access to small foil-covered plastic tubs filled with cream, of the type often provided with coffee in restaurants. Tubs were 3.2 cm in height and tapered from 4 cm in diameter at the top to 2.3 cm in diameter at the base. Before being presented to subjects, each tub was secured in the neck of a 500-ml Pyrex Erlenmeyer flask filled with aquarium gravel for stability. Each flask was placed on a retort stand and a retort ring was lowered to the height of the tub to provide a perch.

Chickadees were pre-trained, trained and tested individually in their home cages. For birds in the Tutored condition, described below, the home cage was an 80 × 80 × 100-cm wire-mesh enclosure divided into two equal compartments by a wire-mesh divider. All other birds were exposed to tubs in identical home cages lacking mesh dividers. Food was removed for the 15-min duration of each trial, and two trials were run per day, one in the morning and one in the afternoon. Each trial was recorded with time-lapse video equipment.

Each of the 16 birds was first given five pre-training trials to determine whether it would spontaneously open tubs. On each of these pre-training trials a sealed cream tub was introduced into a bird's cage for 15 min. Birds which did not open tubs spontaneously during any of the five pre-training trials ($N=12$) were randomly assigned to one of three groups. Each bird in the Tutored group ($N=4$) was given five training trials with a sealed tub in a divided cage while a tutor demonstrating tub-opening was present in the adjacent compartment. Sealed tubs were introduced to both tutor and pupil at the start of each trial and in all cases tutors opened their tubs during each trial.

Subjects in the Open Tub group ($N=4$) were given five training trials with a tub that had been previously opened by the experimenter. An X-shaped cut was made in the foil top of the tub and the foil curled back. Tubs contained no cream, but rather familiar foods: one peanut and one sunflower seed. Birds in the Control group ($N=4$) were given five training trials with a sealed tub. After training trials were completed each of the 12 subjects was given five additional 15-min trials while alone in its home cage with a sealed tub.

The main results are shown in Table I. Four of the 16 birds spontaneously opened tubs on the very first of their five pre-training trials. Three of four birds in the Tutored condition opened tubs during both training and testing. Three of four birds in the Open Tub condition removed food from open tubs during training and later opened sealed tubs during testing. None of the birds in the Control group opened tubs during testing, though one made a small puncture in the foil lids of two tubs during two training trials.

The three birds in the Tutored group that began to open tubs during training varied in their behaviour. One individual began opening on the third training trial and continued on the fourth and fifth trials, in all cases opening its tub shortly after, or while, the tutor opened its tub. Another subject opened tubs on all five training trials, initially with a short latency (<30 s) after the tutor had opened its tub, but on some later trials before the tutor had opened its tub. The third subject opened tubs on the first and fourth training trials only, with latencies of 6–10 min after the tutor had opened its tub.

That one quarter of birds opened the cream tub spontaneously on their first exposure to it is of some interest. If the spread of milk-bottle opening described by Fisher & Hinde (1949) is indeed socially mediated, there may have been a large number of originators in the population, as Hinde & Fisher suggest in a 1972 discussion of their 1949 paper. Partridge (1976) has reported that hand-reared great tits (*Parus major*) develop different preferred feed-

Table I. Cream Tub Opening by Black-capped Chickadees

		Number of birds opening cream tubs in		
	N	Pre-training	Training	Testing
Spontaneous opening	16	4	—	—
Condition				
Control	4	0	1*	0
Tutored	4	0	3	3
Open tub	4	0	3†	3

*Failed to eat.
†Refers to removal of food from open tub (see text).

ing methods, each individual possessing at least one method that it prefers and performs better than other methods. Chickadees in the wild may develop similar preferred feeding methods, some of which can be used to open cream tubs. The puncturing and tearing exhibited by tub-opening birds in the present study may correspond to motor patterns used by these birds in the wild, either to open seeds and insect galls, or to tear bark and expose insects, a point made by Hinde (1982).

Our data further indicate that birds failing to open tubs spontaneously will do so following experience of either of two kinds: observing an experienced bird open tubs, or encountering open tubs containing food. In both Tutored and Open Tub groups a majority of subjects learned to exploit tubs during training and persisted in the behaviour during testing.

It is clear from Fisher & Hinde's (1949) description of milk-bottle opening by free-living birds that experience with previously opened bottles was available to naive birds. Our results suggest that such experience may be sufficient in itself to establish milk-bottle opening in individuals not spontaneously exhibiting the behaviour. The data also show that exposure to a tutor exhibiting tub-opening facilitates the acquisition of that behaviour by conspecifics. Whether the effect of observing the tutor is to direct a familiar feeding behaviour toward a novel feeding site, i.e. a local enhancement effect (Thorpe 1956), or involves more complex cognitive processing by the observer was not explored in the present study.

Our results do, however, show that a behaviour similar to milk-bottle opening may spread through a population as the result of the exposure of naive individuals to environmental modifications produced by the behaviour of individuals exploiting a novel food source, even when the behaviour itself is not observed by naive individuals. The clear implication of our data is that interpretation of the spread of milk-bottle opening as an unequivocal instance of imitative learning by free-living birds is not justified. It may be more appropriate to regard this, and possibly other instances of cultural transmission of learned behaviour observed in nature, as due in part to changes in the environment produced by those individuals introducing novel behaviours into a population.

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