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Effects of access to food during training on social learning by Burmese red junglefowl

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Burmese red junglefowl, *Gallus gallus spadecius*, prefer to feed at sites similar to those where they have previously observed conspecifics foraging successfully (McQuoid & Galef 1992). Both naive fowl exposed to colour video images of conspecific tutors feeding from visually distinctive feeding sites and naive fowl that directly observed conspecific tutors eating at such sites preferred to eat at locations similar to those where they had seen tutors eating (McQuoid & Galef 1992, 1993).

Such laboratory demonstrations of the ability of junglefowl to treat conspecifics as sources of information about where to feed suggest that, in natural circumstances, birds that forage in flocks will use the behaviour of fellow flock members to increase the efficiency with which they discover profitable foraging sites. On the other hand, results of a series of studies of observational learning by pigeons, *Columbia livia* (Giraldeau & Lefebvre 1987) suggest that social learning about feeding behaviour may be inhibited if observing birds are allowed to feed while watching conspecific tutors feed. If eating by observers does, in fact, interfere with their learning by watching when, where or how others feed, then it might not be appropriate to extrapolate from McQuoid & Galef's (1992, 1993) laboratory situations (where observer fowl were not permitted to feed while watching their tutors feed) to more natural situations (where members of a flock might be expected to feed as they observe their fellows foraging).

The present experiment was undertaken to determine whether allowing naive observer fowl to eat while they watched life-size colour video images of trained tutors feeding from visually distinctive foraging sites would interfere with observers acquiring a preference for the type of feeding site where they had seen conspecifics forage successfully.

To begin an experimental session, we placed a pair of 21–28-day-old junglefowl, born and reared in the vivarium of the McMaster University Psychology Department, in a holding cage where pair members were, first, given 24 h ad libitum access to both water and a plain white bowl containing the birds' standard ration (Purina Startina, Ralston-Purina, Woodstock, Ontario), then deprived of food for 24 h. We kept subjects in pairs throughout the experiment because solitary junglefowl often gave distress vocalizations and remained immobile for extended periods.

At the end of the 24-h deprivation period, we released a pair of subjects into a 1×1 m training enclosure, constructed of angle iron and hardware cloth, that had a 33-cm colour-television monitor (Panasonic LT 1331YC) mounted on one wall.

We assigned each pair of subjects to either a control group (15 pairs) or one of two experimental groups (35 pairs). We provided subjects in the control group and in one of the two experimental groups, 'the fed' group (17 pairs), with a white bowl containing 10 g of food. This food bowl was situated directly in front of, and 0·5 m from, the monitor screen in the training enclosure.

Subjects in the remaining experimental group, the 'not-fed' group (18 pair of fowl) were released into a training enclosure that did not have a food bowl in it.

Each pair of subjects was left in the training enclosure for 32 min. While there, pairs of subjects in the control group each viewed one of two videotapes that showed a life-size image of a white bowl marked with either red or blue decals. Subject pairs in the two experimental groups each viewed one of two videotapes that showed a pair of junglefowl actively feeding from a white bowl marked with either red or blue decals.

At the end of the training period, each pair of subjects was returned to its holding enclosure, fed ad libitum for 24 h and then, in anticipation of testing, deprived of food for 24 h.

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Table I. Behaviour of observer fowl during training and testing

Group	Training condition		
	Experimental fed	Experimental not-fed	Control
$\bar{X} \pm$ SE min feeding during training	$10{\cdot}6 \pm 1{\cdot}4^a$	—	$16{\cdot}7 \pm 1{\cdot}4^b$
% First pecks to trained dish	$80{\cdot}0^a$	$93{\cdot}3^a$	$38{\cdot}5^b$
% Observers pecking longer from trained dish	$80{\cdot}0^a$	$86{\cdot}6^a$	$30{\cdot}8^b$
$\bar{X} \pm$ SE total min pecking during testing	$13{\cdot}4 \pm 1{\cdot}8^a$	$7{\cdot}1 \pm 0{\cdot}8^b$	$12{\cdot}1 \pm 1{\cdot}2^a$

Cells in the same row with different superscripts differed significantly.

During testing, which occurred 48 h after training, we allowed each pair of subjects access for 10 min to a 1 × 1 m cage containing two white bowls: one marked with red decals and the other marked with blue decals. Each bowl contained 10 g of the subjects' standard ration and each was filled with strips of newsprint that prevented subjects from seeing the food in the bottom of the bowls.

We noted both the type of bowl (marked with blue or red decals) in which each subject first pecked and the amount of time subjects spent pecking in each bowl during the 10-min test period.

As is evident from examination of Table.I, there was a significant effect of training condition on the probability that, during testing, subjects would: (1) peck first in the type of marked bowl they had observed during training ($\chi^2=11{\cdot}32$, $df=2$, $P<0{\cdot}01$) and (2) spend the majority of the test period pecking in the type of bowl that they had observed during training ($\chi^2=11{\cdot}75$, $df=2$, $P<0{\cdot}01$). Post-hoc tests revealed that subjects in the two experimental groups (groups that, during training, had seen tutors feed from bowls marked with either red or blue decals) were more likely than were subjects in the control group (the group that, during training, had simply seen a food bowl marked with either red or blue decals): (1) to initiate pecking in the type of bowl that they had observed during training (Fisher's exact probability test, $P=0{\cdot}003$) and (2) to spend the majority of the test period pecking in the type of bowl that they had observed during training (Fisher's exact probability test, $P=0{\cdot}001$). Although subjects assigned to the fed group in the experimental condition exhibited a slight attenuation of social influence on their food bowl preferences relative to subjects assigned to the not-fed group in the experimental condition, this attenuation did not approach acceptable levels of statistical significance (Fisher's exact probability tests, both Ps$>0{\cdot}29$). Thus, social learning about visually distinctive feeding sites proceeded normally even when, during training, observers both fed and observed their tutors feeding.

Comparison of the amount of time spent feeding during training by subjects assigned to control and experimental-fed groups indicated that presentation of videotapes of the sight and sound of feeding conspecifics reduced the amount of time that subjects spent feeding during their training sessions (Student's $t=3{\cdot}38$, $P<0{\cdot}01$). This attenuation of time spent feeding during training by subjects in the fed group of experimental subjects appeared to reflect, at least in part, the time that experimental subjects in the fed group spent looking at television images of feeding conspecifics. Orientation towards the video monitor seemed to delay these subjects' exploration of the training cage and discovery of food in the bowl present there.

Experience of feeding during training also increased the total amount of time that observers spent feeding during testing (ANOVA, $F_{1,2}=11{\cdot}0$, $P<0{\cdot}001$). One might speculate that this enhanced feeding during testing was the result of the opportunity to feed from bowls in the test apparatus experienced during training by subjects assigned to both the fed-experimental group and control group, but not by subjects assigned to the not-fed experimental group.

The main results of the present experiment provide evidence, comparable to that in Giraldeau & Templeton (1991, experiment 2) and Mason & Reidinger (1981), suggesting that feeding during a period of observation of the foraging behaviour of conspecifics need not interfere with avian social learning. In the only previous study designed to address directly the question of whether feeding

by observers affects their social learning, Giraldeau & Templeton (1991) reported contradictory results. In Giraldeau & Templeton's experiment 1, there was a significant main effect of observers feeding or not feeding during training on the probability that they would learn by watching others, a significant main effect of whether tutors were feeding or not feeding on the probability that observers would learn by observing those tutors and no significant interaction. In their experiment 2, feeding or not feeding during training by observers had no effect on social learning by observers of fed tutors.

The results of Giraldeau & Templeton's (1991) first experiment (but not of their second) cast doubt on the validity of extrapolation from laboratory experiments in which subjects are not allowed to feed while observing tutors to natural circumstances (where fowl are likely to be feeding at the same time they observe foraging flock mates feeding; e.g. McQuoid & Galef 1992, 1993). The present results, consistent with those of Giraldeau & Templeton's second experiment, provide additional evidence that, even while foraging for themselves, fowl feeding in flocks can acquire useful information from fellow flock members about the types of foraging sites where food is to be found. Thus the present results increase the confidence that findings reported both in McQuoid & Galef (1992, 1993) and in other laboratory experiments in which observers were not fed while watching the behaviour of conspecifics (see Zentall & Galef 1988 for examples) can be extrapolated to extra-laboratory environments.

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REFERENCES

Giraldeau, L. A. & Lefebvre, L. 1987. Scrounging prevents cultural transmission of food-finding behaviour in pigeons. *Anim. Behav.*, **35**, 387–394.

Giraldeau, L. A. & Templeton, J. J. 1991. Food scrounging and diffusion of foraging skills in pigeons, *Columbia livia*: the importance of tutor and observer rewards. *Ethology*, **89**, 63–72.

McQuoid, L. M. & Galef, B. G., Jr. 1992. Social influences on feeding site selection by Burmese fowl. *J. comp. Psychol.*, **106**, 137–141.

McQuoid, L. M. & Galef, B. G., Jr. 1993. Social stimuli influencing feeding behaviour of Burmese fowl: a video analysis. *Anim. Behav.*, **46**, 13–22.

Mason, J. R. & Reidinger, R. F., Jr. 1981. Effects of social facilitation and observational learning on feeding behavior of the red-winged blackbird (*Ageliaus phoeniceus*). *Auk*, **98**, 778–784.

Zentall, T. S. & Galef, B. G., Jr. 1988. *Social Learning: Psychological and Biological Perspectives*. Hillsdale, New Jersey: Erlbaum.