References and Notes

1. O. Krayer and J. Fuentes, *J. Pharmacol. Exptl. Therap.* 123, 145 (1958); M. K. Paasonen and O. Krayer, *ibid.* 123, 153 (1958).
2. D. Waud, S. R. Kottegoda, O. Krayer, *J. Pharmacol. Exptl. Therap.*, in press.
3. J. H. Burn and M. J. Rand, *Brit. Med. J.* 1, 137 (1958).
4. E. Muscholl and M. Vogt, *J. Physiol. (London)* 141, 132 (1958).

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Influence of Social Interactions on Learning Rates in Birds

That learning may be influenced by the behavior of an individual's congeners is fairly obvious (*1*). Relatively little evidence exists, however, demonstrating the role of observational learning among animals in their normal environment, though such evidence as there is indicates that imitational behavior may play a major role in the ontogeny of species-specific response patterns (*2*).

Previous work has shown, for example, that the learning of feeding and avoidance responses by greenfinches (*Chloris chloris*) is greatly affected by the presence of a second individual (*3*). While single birds learned a discrimination rapidly, as did birds which had been trained after having been allowed to observe an already trained bird performing, birds which were being trained in the presence of a naive partner required considerably longer. Finally, when well-trained birds observed the performances of untrained partners, their own performances, which had previously been correct, repeatedly fluctuated to random, or nondiscriminatory, levels. Behavioral data suggested that temporary effects such as social facilitation were not involved, but, rather, that the sight of another bird feeding can actually serve as an unconditioned stimulus potent enough to overcome the negatively reenforcing effect of noxious food.

In the experiments described in this report (*4*) the speed with which adult, wild-trapped greenfinches learned to discriminate between a palatable and unpalatable food source was compared for single birds and heterosexual pairs. These birds were housed in wire-mesh aviaries of volume approximately 110 ft,[3] and located on the edge of a wood, in conditions approximating the natural habitat of the species. Food and water were available *ad libitum*, and adequate plant cover and perches were provided. In addition, in each cage was placed a sprig of box (*Buxus* sp.) and ivy (*Hedera* sp.) to whose leaves were glued sunflower seeds or sunflower seeds with moist aspirin replacing the kernel. There were six seeds on each sprig, single birds receiving one pair of sprigs (box and ivy), paired birds receiving twice that number. The sprigs were replenished twice daily. For half of the birds the ivy served as the source of the noxious food (aspirin filled seeds); for the other half of it was box. An error was scored as a failure to take a palatable seed or as the seizing of an unpalatable one. The criterion for seizing was the splitting of a seed or its removal. After the first few trials, virtually all errors were due to taking the incorrect seed rather than to failure to feed.

Because weather conditions and day length were known to affect motivation and hence learning speed, the only valid comparisons that can be made are between paired and single birds which were tested simultaneously. The data given in Table 1, when presented in this fashion, show a striking parallel with those achieved in the previous experiments, which were conducted in a more artificial fashion (*3*). In eight instances the single birds, whether male or female, learned with considerably greater rapidity than the paired birds, who, in several instances, failed to learn the discrimination altogether. In the single instances where the pair learned as rapidly as the single control, observations established that only the female was, in fact, responding. In all other pairs, both birds simultaneously participated in the feeding, at least during the observation period.

This interference with discrimination learning in social situations can fail to be maladaptive only among species whose feeding responses are so conservative as to virtually eliminate the likelihood of their feeding on some unsuitable or noxious food. As earlier work has suggested (*3*), the observation of a partner's feeding response is powerful enough a stimulus, even after delays of 24 hours, to overcome previously established avoidance behavior. Presumably this will not be true of species with a more varied diet or a more opportunistic feeding habit than greenfinches. One might also expect a different situation in species which remain in flocks throughout the year. Investigation of these possibilities should be of considerable value in an elucidation of the relation between learning processes and social organization.

Table 1. Number of errors on successive trials for paired and single greenfinches. The differences between paired and single birds were significant ($p = .05$ or less). Trials were discontinued as soon as one group was discriminating with an accuracy of 11 or less errors in three consecutive trials, this number of errors representing a significant level of discrimination ($p = .05$ or less). The errors made by the single bird were doubled, in order to make direct comparisons possible. The minus signs (−) refer to trials on which the birds did not take either palatable or unpalatable seeds.

Bird	Errors
Pair 1	12, −, 14, 9, 3, 6*
Male 1	−, −, 6, 0, 2, 0
Pair 2	12, 13, 9, 9, 9, 9, 10, 8, 8
Male 2	6, 10, 12, 12, 10, 12, 4, 2, 2
Pair 3a	−, −, 9, 6, 7, −, 6, −, 4, 2, 0, 3, 3, 0, 0†
Pair 3b	11, 8, 12, 7, 12, 7, 7, 6, 10, 6, 8, 4, 1, 11, 7
Male 3	−, −, 16, 2, 12, −, −, −, 4, 2, 4, 0, 4, 0
Pair 4	11, 7, 11, 7, 5, 7, 1, 7, 4, 11, 5, 6, 2, 1, 0
Male 4	−, 12, 6, 4, 0, 2, 2, 0
Pair 5	−, −, 12, −, 15, 12, 5, 9, 11, 9, 8, 12, 11, 12
Female 5	12, 10, 8, 4, 0, 0, 0, 0
Pair 6	15, 12, 10, 8, 12, 11, 11, 9
Male 6	−, 16, 6, 2, 2, 6, 2, 2
Pair 7	−, −, 12, 11, 8, 11, 7, 14, 12, 8
Female 7	10, −, −, 6, 2, 6, 0, 6, 0, 0
Pair 8	12, 12, 12, 12, 12, 12, 12, 12
Male 8	8, 6, 0, 4, 10, 4, 6, 4

* Escaped. † Only the female responded.

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References and Notes

1. N. E. Miller and J. C. Dollard, *Social Learning and Imitation* (Yale Univ. Press, New Haven, 1941).
2. J. A. King, *Contribs. Lab. Vertebrate Biol. Univ. Michigan No. 67* (1955); P. H. Klopfer, *Am. Naturalist* **91**, 61 (1957).
3. P. H. Klopfer, *Behavior*, in press.

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