

The Following Reaction in a Brood of Mute Swans.—On July 4, 1955, S. von Hofsten and I were observing a Mute Swan (*Cygnus olor*) and its brood of 3 cygnets about 3 or 4 days old at Ekebysjön, a few miles outside Stockholm, Sweden. For over half an hour we watched them and many other waterfowl from the north shore of the lake at a distance of about 200 feet. We then moved over to the other side at about the same distance from the swans.

After a while the parent, followed by the cygnets, swam away from the shelter of the reeds where they had been feeding. Arrived opposite the place where we stood, the swan suddenly rose and flew out of our sight to the western end of the lake some 1500 feet away, leaving the cygnets exposed and alone in the middle of the water.

At the disappearance of the parent, the cygnets at first swam around in confusion, giving loud "lost piping" notes. A minute later they bunched together, their "lost piping" gradually subsiding. Very soon we saw them in string formation paddling off in precisely the direction the adult swan had flown. They swam on and on, undismayed by the other waterfowl, unswerving in their course through tongues of lily-pads and sparse growth of reeds straight toward the west end of the lake.

To us it seemed impossible for the cygnets, floating low upon the water and with water-lilies and reeds intervening, to see their parent once it had alighted on the lake. Nor could we, from where we stood, hear either the parent or the young giving any calls.

The first three reactions of the cygnets upon being abandoned, their "lost piping," their confusion, and their bunching together, were common enough. This behavior pattern agrees with the findings of Drs. Tinbergen, Lorenz, Fabricius, and others, in their experimental work on ducks.

More remarkable was the orientation of these cygnets as they moved off on a determined course through rather formidable obstacles for such tiny swimmers towards a distant, presumably invisible, parent object. Obviously, they were driven by a high intensity motivation which was released by a visual stimulus no longer perceivable by the senses. We may also ask, was the impulse to follow present in only the leading cygnet, or to a higher degree in it than in the others? Or was the whole performance cooperative?

Fabricius and Boyd in "Experiments on the Following Reaction of Ducklings" (Wildfowl Trust Annual Report 1952-53) remark on the "complexity and variety of the interactions between different processes that make up even a simple behaviour pattern" and on the great variation of response in individuals "with similar histories," such as this brood of cygnets. It would seem, therefore, that nature may often provide the necessary relieving circumstances, as in this case, whereby apparently desperate situations in the wild can be successfully resolved.—LOUISE DE KIRILINE LAWRENCE, *Rutherglen, Ontario, Canada.*

Behavior of a Pratincole.—During the fall and winter of 1954 and the spring of 1955, I had an opportunity to observe some hostile behavior patterns in an Oriental Pratincole (*Glareola maldivarum* or *G. pratincola maldivarum*) at the New York Zoological Park.

This bird was kept in a small aviary, with many passerines (mostly estrildine finches) and a few larger birds (such as sandgrouse and quail).

Various disputes and fights were not uncommon in the aviary. The pratincole was remarkably sluggish when left alone; but it was vigorous in attempting to maintain an "individual distance" area around itself, within which it would not

willingly allow any other bird to approach. It was sometimes forced to escape before the larger birds; but it could usually induce the smaller trespassers to stop or retreat. This was accomplished by attacking the trespassers, by directing unmistakably hostile displays toward them, or by alternating attack intention movements and hostile displays in rapid succession.

One type of hostile display, particularly common in the spring, was a harsh, loud "chirrup" note, or a brief series of two or three similar "chirrup" notes. These sounds were usually accompanied by movements: the head was lifted and pointed slightly upward, and the neck was simultaneously stretched upward and forward. Such movements were variable, rapid, and almost always very brief.

A second type of hostile display, apparently threat (see Moynihan, *Auk*, 72: 247-259, 1955), was somewhat more elaborate and often more prolonged. It included a characteristic twittering call and one or two distinctive postures.

The twittering call itself was a rapid series of high-pitched, faint, rather melodious, monosyllabic notes (impossible to transcribe adequately). The number of notes varied from two or three to more than a dozen. This utterance was quite different, in quality, from any of the calls of the gulls, terns, and shorebirds with which I am familiar. In rhythm, however, it was slightly reminiscent of some staccato "long calls" and "crackling calls" of certain gulls (summarized in Moynihan, *Behaviour*, Supplement 4: 1-206, 1955), and also, probably, the "gakkering" call of the Sandwich Tern (described by van den Assem, *De Levende Natuur*, 57: 1-9, 1954).

The typical posture associated with twittering was assumed as soon as the call began. The bird stretched its head and neck downward and forward; and usually maintained this posture, while the call continued, until its opponent escaped or a fight developed.

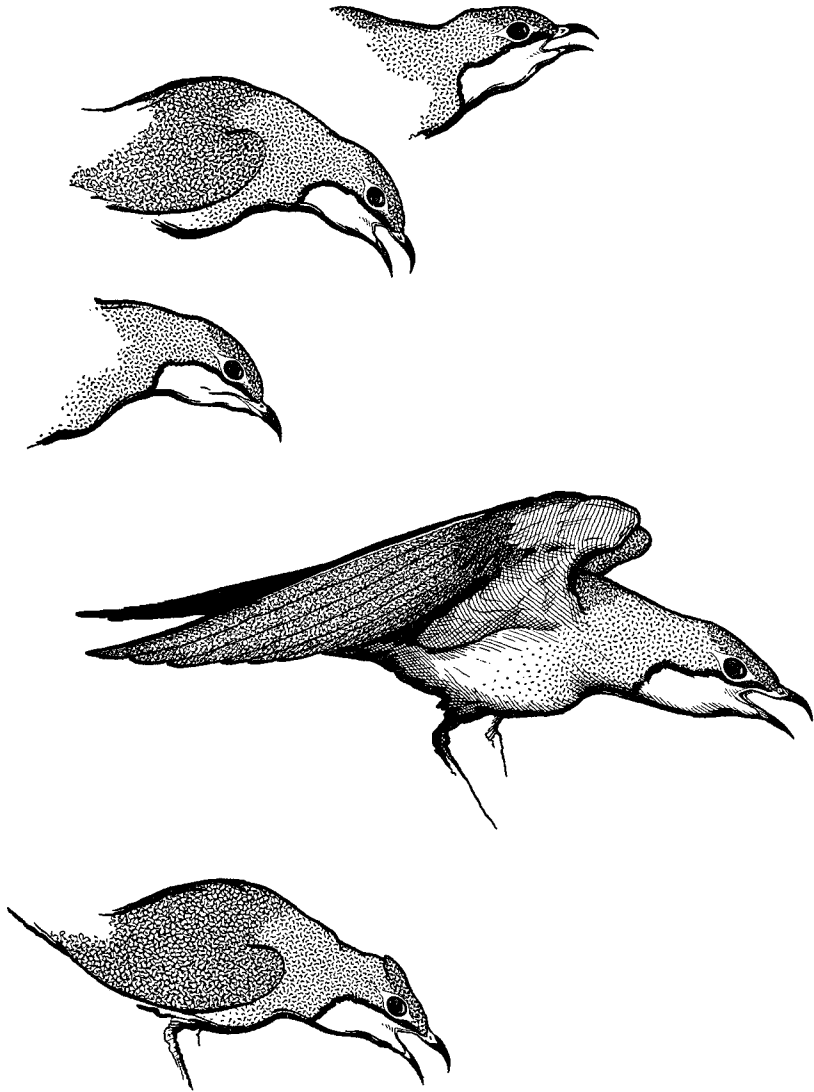
The motivation of this performance, like that of most threat displays in other birds, was obviously composed of conflicting attack and escape tendencies. These tendencies, or drives, seemed to fluctuate in relative and actual strength; and these fluctuations, in turn, seemed to be correlated with variations in the physical form of the display.

Thus, for instance, the extent to which the bill was opened and the neck was stretched seemed to depend upon the strength of both drives. When both were weak, the bill was closed and the neck was short (Figure C.). The neck became longer and the bill was opened more widely as the intensity of the two drives increased (Figure B.).

The head and neck were sometimes held in an approximately straight line; but this was relatively rare. The head was usually held at a slightly different angle, pointing more strongly downward than the neck. The most extensive downward inclination of the head seemed to be diagnostic of situations in which the pratincole was "timid" or "frightened," i.e. obviously reluctant to attack with full force. This would suggest that the extreme downward pointing of the head was produced by a relatively strong escape tendency, an escape drive somewhat more strongly activated than the attack drive.

The angle of the neck was usually rather stable. Occasionally, however, just before attacking, the bird would suddenly stretch its neck upward (Figure A.) and twitter more loudly. This would suggest that the upward movement occurred when the attack drive was much stronger than the escape drive.

A very conspicuous movement was sometimes superimposed upon the twittering posture. The bird would suddenly raise its arms, apparently without flexing or



POSTURES ASSOCIATED WITH THE TWITTERING CALL OF THE ORIENTAL PRATINCOLE.
 From top to bottom. A. Occasional posture before attack. B. Typical moderate-intensity posture. C. Typical low-intensity posture. D. High-intensity posture with wings raised. E. Moderate-intensity posture with "crest" raised.

rotating the carpi (Figure D.), and then as suddenly lower them again. This movement was most effective in revealing the rufous on the underside of the wing as a brilliant flash of color. It was so rarely performed that the causal factors responsible for its production were difficult to determine; but it seemed to appear when both types of hostile motivation were at their strongest possible (at their strongest, that is, in this particular environment).

Both the twittering postures and wing-movements can be easily explained as combinations of advance, retreat, and flying intention movements; movements which have become more or less thoroughly ritualized (i.e. have become standardized and acquired a function as social signals).

Another behavior pattern, sometimes superimposed upon the typical twittering posture, was more obscure in function and derivation. The bird would sometimes raise its crown feathers, slightly darker than the surrounding plumage, to form a definite, if not very conspicuous, crest (Figure E.). This was also accompanied, in some cases at least, by a slight raising or ruffling of the back and scapular feathers.

Such infrequent ruffling seemed to be a low-intensity indication of a more extreme behavior pattern usually produced after the completion of these hostile displays (both the "chirrup" and twittering). As soon as the pratincole had stopped displaying and relaxed its posture, it would ruffle all its head, neck, and body feathers, shake out its wings, and then smooth its whole plumage down again.

Ruffling and shaking are obviously "comfort movements" or derived from comfort movements; but their apparent standardization after hostile display might suggest that they may also subserve a social signal function, in a more natural environment, during intra-specific disputes.

The significance of any reaction by a caged bird, of course, is always difficult to analyze; and the hostile behavior patterns described in the preceding paragraphs may comprise no more than a small fraction of the total hostile behavior shown by Oriental Pratincoles in the wild. (Yeates [Brit. Birds, 41: 301-303, 1948], has described several apparently hostile patterns of the Common Pratincole [*G. p. pratincola*] breeding in the Camargue. Some of these patterns may be related to those described above; but the nature and extent of such possible relationships must remain indeterminate until further studies have been made.)

If, therefore, the hostile behavior patterns of this captive Oriental Pratincole have been discussed in some detail, it is only because they have a certain evolutionary interest. They resemble certain hostile displays of gulls and terns. The rhythm of the twittering call has already been mentioned in this connection, but the associated movements and postures are even more suggestive. Certain threat displays of the Laughing Gull and the Sandwich Tern include a ruffling component (Noble and Wurm, Ann. N. Y. Acad. Sci., 45: 179-220, 1943; van den Assem, *op. cit.*, 1954), and so do other displays in such species as the Franklin's Gull (personal observation). More important, the various twittering postures are quite similar in form to some of the "oblique," "low oblique," and "head-down" threat display postures that have been found in many different species of gulls and skuas (see Moynihan, Behaviour, Supplement 4: 1-206, 1955); and this captive pratincole assumed these postures and began twittering in situations very much like those in which many captive gulls would assume an "oblique," "low oblique," or "head-down" posture and begin the "long call."

This hostile behavior may thus provide further evidence of the close relationship between the families Glareolidae and Laridae within the order Charadriiformes.—M. MOYNIHAN, Department of Conservation, Cornell University, Ithaca, New York.