shoulder-spot display during their observations of behavior in partridges. In all cases that I observed, the shoulder spot appeared to be a fear or flight intention display as described by Lumsden (1970). However, the display seemed secondary in importance compared to vocalizations and "tail flicking" during periods of extreme alarm. Examination of the shoulder spot of a partridge confirmed the realignment of white underwing coverts to the top of the wing in the patagial region. The manipulation by the bird of underwing feathers appeared to be identical to that of Ruffed Grouse (*Bonasa umbellus*) (Garbutt 1981). Since "display" implies actual communication between individuals further investigation is needed to determine if, in fact, the shoulder spot actually is serving a communication function in Gray Partridge.

The shoulder spot in Gray Partridges and the display seen in grouse are morphologically similar. Lumsden (1970) concluded that the widespread occurrence of this display among grouse indicated it appeared relatively early in evolution. The morphological and behavioral similarities between the display in grouse and partridges suggest that the shoulder spot may have evolved even earlier. Since this is an escape behavior, and since many species of partridges and pheasants are difficult to observe in the wild, it may have been overlooked.

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Head-scratching method in swallows depends on behavioral context.—Birds scratch the head by raising the foot dorsal to the lowered wing (overwing or indirect method) or by passing the foot ventral to the folded wing (underwing or direct method). The adaptive significance of the two methods has puzzled ornithologists since Heinroth (1917) first de-

scribed the behavior. Intraspecific variation appears rare (Simmons 1961, Burtt 1983) and confined to ontogenetic changes from underwing to overwing head-scratching, to captive or injured birds that revert from overwing to underwing head-scratching, and to rare, isolated underwing head-scratching in species that normally head-scratch over the wing (Burtt and Hailman 1978). Only the Black-and-white Warbler (*Mniotilta varia,* Burtt 1980) and Hairy Woodpecker (*Picoides villosus,* Dunham 1963) have been seen using both head-scratching methods interchangeably. Individuals of both species were preening when observed, but preening is the behavioral context most often associated with head-scratching (Burtt and Hailman 1978). Observations of swallows suggest that, in flight, underwing head-scratching is used by healthy, adult birds that head-scratch over the wing in other behavioral contexts.

Our data are based on field observations by Burtt in Delaware County, Ohio from 1978 to 1987; by Bitterbaum in Florida, Trinidad, Tobago, and Mexico from 1977 to 1980; and by Hailman throughout North America and the West Indies from 1960 to 1987. The data are presented taxonomically according to the A.O.U. Check-list (1983), supplemented by Meyer de Schauensee (1970).

When perched or standing on the ground, all species of swallows listed in Table 1 head-scratched over the wing. Head-scratching was relatively rare, but occurred most often during maintenance behavior and less often during resting, vocal, or locomotory behavior. In Delaware County, head-scratching was most frequent from mid-July through August and may be associated with molt of the head feathers as observed in Kirtland's Warbler (*Dendroica kirtlandii,* Mayfield 1960). Alternatively, swallows congregate in mixed-species, premigratory flocks from mid-July through August when head-scratching may be more easily observed than at other times of the year.

On eleven occasions flying swallows were observed scratching their heads (Table 1). While head-scratching, swallows glided with the wings stretched horizontally or down to 10° below the horizontal. The tail was depressed 30–40° below the horizontal, the head was lowered and turned so that the side to be scratched was toward the extended foot. The foot was extended forward ventral to the wing and the shoulder in a position analogous to that of underwing head-scratching in perched birds. The foot not scratching remained tucked into the ventral plumage. Head-scratching in flight followed in-flight bathing on 5 of 6 occasions observed by Burtt, but was not limited to such occurrences as illustrated by one Tree Swallow (*Tachycineta bicolor*) observed head-scratching while gliding over a field.

Head-scratching with the wings extended may not be analogous to head-scratching when perched with the wings folded. Nonetheless, swallows extend the leg ventral to the shoulder during in-flight head-scratching, whereas perched swallows extend the leg dorsal to the shoulder during overwing head-scratching. Furthermore, swallows can glide with the wings depressed 30° below the horizontal, a negative dyhedral that would seem to allow overwing head-scratching in flight. Thus, head-scratching in flight resembles underwing head-scratching, and swallows appear capable of reaching over a depressed wing while gliding.

Swallows commonly drink and bathe on the wing, dipping into the water from an extended glide then rising into the air on rapidly flapping wings and shaking the entire body (Slessers 1970, Wolinski 1985, Burtt pers. obs.). Parents also feed fledged young while in flight. Parent and young approach, hover, and exchange food (Burtt 1977, Hailman pers. obs.). Such complex aerial behavior suggests that the method of aerial head-scratching is not restricted by behavioral limitations of flight.

Without exception, all observations of perched or standing swallows are of overwing head-scratching (Table 1). Thus overwing head-scratching appears to be the usual method among perched swallows. Six of 12 species have been observed head-scratching in flight and all six species used the underwing method (Table 1). Two species have been seen head-scratching in flight more than once (Table 1) and all observations were of underwing head-scratching.

TABLE 1
COMPARISON OF HEAD-SCRATCHING METHOD IN PERCHED AND FLYING SWALLOWS

Species	Number of observations			
	Perched		In flight	
	Underwing	Overwing	Underwing	Overwing
Purple Martin	0	29	0	0
(*Progne subis*)	0	0	X[a]	0
	0	0	1[b]	0
Caribbean Martin (*P. dominicensis*)	0	7	0	0
Gray-breasted Martin (*P. chalybea*)	0	17	3	0
Tree Swallow (*Tachycineta bicolor*)	0	52	4	0
White-winged Swallow (*T. albiventer*)	0	4	1	0
Violet-green Swallow (*T. thalassina*)	0	1	0	0
Blue and White Swallow (*Pygochelidon cyanoleuca*)	0	2	0	0
Northern Rough-winged Swallow (*Stelgidopteryx serripennis*)	0	13	1	0
Southern Rough-winged Swallow (*S. ruficollis*)	0	6	0	0
Cliff Swallow (*Hirundo pyrrhonota*)	0	6	0	0
Cave Swallow (*H. fulva*)	0	3	0	0
Barn Swallow (*H. rustica*)	0	23[c]	1	0
Totals	0	163	11+	0

[a] Observed, but number unknown; C. R. Brown pers. comm.
[b] Wolinski 1985.
[c] One observation was of a Barn Swallow standing on a road sunbathing when it head-scratched over the wing.

Thus underwing head-scratching appears to be the usual method among flying swallows. These data indicate that head-scratching method in swallows is context-dependent.

Earlier studies (Heinroth 1917, 1930; Lorenz 1950; Burtt and Hailman 1978) showed that all variation in head-scratching method was among species that normally head-scratch over the wing, but as nestlings, when captive or injured, or on rare occasions, head-scratched under the wing. Such consistency in the pattern of variation suggests that underwing head-scratching is primitive and overwing head-scratching derived. But what is the adaptive significance of the alternative head-scratching patterns? Swallows head-scratch over the wing while perched and under the wing while flying. The center of gravity is above and between the feet while perched, below and slightly behind the wings while flying. The swallow's shift in head-scratching method associated with its shift in center of gravity relative to its loco-

motory systems suggests that subtle differences among species' center of gravity may explain the adaptive significance of interspecific differences in head-scratching method.

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The usefulness of taped Spotless Crake calls as a census technique.—Playing taped calls of Spotless Crakes (*Porzana tabuensis*) has been used successfully to determine the presence of crakes and to identify the habitat they use in New Zealand (Ogle and Cheyne 1981). In this study, calls of Spotless Crakes were broadcast throughout the breeding season at given locations to evaluate the crake's consistency of reaction to taped calls. This study was conducted at Pukepuke Lagoon, an 86-ha management reserve of the New Zealand Wildlife Service in the Manawatu district of the North Island, New Zealand, latitude 40°20'S, lon-