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DOMINANCE AND PROXIMITY IN CAPTIVE GREY-BREASTED SILVEREYES

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SUMMARY

Results of this study suggest a significant correlation between dominance relationships and spatial relationships between subordinate birds and the dominant bird in a captive group of Grey-breasted Silvereyes *Zosterops lateralis*. Such a correlation implies that the spatial arrangement of these birds may be used to predict dominance relationships and, perhaps, the existence of pair bonds among some group members.

INTRODUCTION

Differential spacing of conspecifics is a general feature of social behaviour (McBride 1968) and is easily observed and quantified in many species of animals. McBride (1968) suggests that dominance is largely spacing behaviour, conferring priority of access to resources through control of space. This implies a relationship between an animal's social rank and the distance that it maintains between itself and other members of a group. My study was designed to test this theoretical association. If proximity and dominance are related, measures of spatial pattern should predict social relationships among group-living animals.

Many studies have revealed a correlation between aggression and spatial proximity. My study was concerned with the association of dominance and spatial proximity. Aggression and dominance are different (Kikkawa 1968) and therefore the aforementioned studies are not directly comparable to this investigation.

Generally speaking, there are many ways to measure dominance and the hierarchies that result from these different measurements may not be the same for any one group of animals. One of the results of dominance is "priority of access to the necessities of ..... reproduction" (Wilson 1975), and I discuss the relationship between proximity and accessibility.

METHODS

I observed a captive group of seven Grey-breasted Silvereyes *Zosterops lateralis* from a winter flock. There were three adult males (hereafter referred to as B, F and G), three adult females (C, D and E) and one juvenile (H) of unknown sex. Each bird could be recognized by its combination of coloured legbands. The group was kept at the University of Queensland in an aviary, approximately 2.7 x 2.1 x 1.8 m, containing a small shrub for roosting, a feeding table with a T-perch, a pan for water and three perches suspended 40 cm from the ceiling and marked at 5 cm intervals. Apples, oranges and a high-nutrient mash were supplied *ad libitum*, except during ranking experiments. I observed the birds through a small window centrally located at the front of the aviary on 19-21 April 1977.

Agonistic encounters between certain birds were rare. To increase the frequency of such interactions the group was subjected to 30-minute periods when all food and water were removed from the aviary. Following this, half an apple was placed in the centre of the T-perch. Using supplanting behaviour as a criterion for dominance (Brown 1975), I recorded the outcomes of interaction between birds at this feeder; a bird supplanting another being the "winner" and the supplanted bird the "loser". Instances of feeding together or of mutual tolerance were scored as victories for each participant.

My preliminary observations suggested that B, a male, interacted most frequently with other birds and won nearly every encounter. Data obtained from interactions at the feeder confirmed this notion and B was therefore considered the most dominant bird in the group. I ranked the remaining six birds in relation to B by the magnitude of the proportion of wins during their encounters with him. The bird with the greatest proportion of wins was given the highest rank (=1). Kikkawa (1961) notes that subordinate birds avoid encounters with dominant individuals. Hence, in the case of equal values for the proportions of wins by F and H, the total number of interactions was used as a criterion for dominance and the individual with the fewer interactions was assigned the lower rank. It should be noted that dominance relationships among the six subordinates were not established, primarily because encounters between some birds were rare.

Photographs of the entire aviary were taken at 3-minute intervals on 21 April 1977 using Ektachrome film and a Nikkormat EL 35 mm camera fitted with a 28 mm Nikon lens. The camera was mounted on a tripod so that all photographs were taken at the same angle and subject to the same spatial distortions that may occur when a wide-angle lens is used. Rondinelli and Klein (1976) suggest that spatial associations could result from differential participation in certain activities, but this factor was not considered here because all the birds were relatively inactive (perched) when all photographs were taken.

Eighteen photographs yielded 18 sets of x,y coordinates that described the location of each of the seven birds as determined by the point midway between each bird's legs. "Settled distances" (see Crook 1961) between B and each of the other six birds (C-H) were computed using the formula:

$$d = \sqrt{(x_S - x_B)^2 + (y_S - y_B)^2}$$

where the subscript S refers to the location of the subordinate bird in question and the subscript B refers to B's location.

There are, of course, three dimensions in an aviary. I did not consider the third dimension because all three perches were hung at the same height. Each of the six subordinate birds was ranked according to the magnitude of $\bar{d}$, the average distance (n=18) between it and B. The bird with the smallest $\bar{d}$ was assigned a rank of 1, indicating that it showed, on average, closest proximity to B.

RESULTS

The proportion of wins and a dominance rank for each of the subordinates are given in Table 1. Females occupied the top three positions in the dominance ranking and males two of the three bottom positions. C, a female, had the highest proportion of wins during encounters with B. No aggressive encounters were observed between C and B; they displayed mutual tolerance and often fed together and these activities were scored as wins for both birds. They were presumably paired.

Values of $\bar{d}$ and a proximity rank for each subordinate bird are also given in Table 1. Once again, females occupied the top three positions in the ranking and males assumed two of the bottom three positions. Here, too, C had the highest proximity rank, implying that, on average, she was closer to B than were any of the other five subordinates. H, the juvenile, occupied the lowest position in both hierarchies, reflecting his subordinance and his avoidance of B.

Table 1. Proportions of wins, dominance ranks, values of d and proximity ranks for subordinate Silvereyes in a captive winter group.

BIRD	SEX*	PROPORTION OF WINS	DOMINANCE RANK	$\bar{d}$ (cms)	PROXIMITY RANK
C	F	1.00	1	37.3	1
D	F	0.31	3	56.3	2
E	F	0.50	2	58.5	3
F	M	0.00	5	60.2	4
G	M	0.10	4	67.8	5
H	M	0.00	6	87.8	6

* M = male

F = female

Spearman's coefficient of rank correlation (described in Siegel 1956) was calculated to test the null hypothesis of no association between the dominance ranks and proximity ranks of subordinate birds relative to B. The correlation was statistically significant (r_s = 0.886, n = 6, P 0.05, two-tailed test) and the null hypothesis was rejected.

DISCUSSION

The concept of social dominance and various physiological and social determinants of an individual's rank in a hierarchy have been previously summarized (Hinde 1970, Wilson 1975). But spacing behaviour, particularly the concept of "individual distance", and the factors affecting an animal's tolerance of conspecifics are worth discussing briefly.

"Individual distance" was first defined by Hediger (1955) as the distance that an animal keeps between itself and a conspecific. He used the magnitude of individual distances to classify species of animals into two groups. "Contact species" (e.g. Silvereyes) were those whose members maintained relatively small individual distances, facilitating, for example, communal roosting, allopreening and allofeeding. Members of 'distance species' avoided close spatial contact with conspecifics.

Hediger's distinction is useful because it allows a general separation of species on the basis of their gregariousness. What must be remembered is that within any species each individual has its own spacing tendency in relation to conspecifics (Thompson 1969). For example, Zebra Finches *Poephila guttata*, a "contact species", may tolerate the close proximity of group-mates, but each bird displays a different amount of tolerance (Caryl 1975); some allow particular conspecifics to remain near but supplant other birds when they approach. Thus, the nature of a bird's spacing behaviour is not as genetically fixed and as species-specific as Hediger's definition might imply.

Throughout this paper, I have equated a measured distance with proximity and accessibility of birds to one another. Wickler (1976) argues that animals use criteria other than physical distance to gauge accessibility. That is, the same measured distance could be deemed "different" by two animals depending on the circumstances in which they find themselves. For example, imagine two birds perched 10 m from each other, one in a strong "threat" posture and the other preening quietly. Now imagine a subordinate bird between these two. The bird in the middle may well consider the threatening bird to be less accessible than the preening bird, as the risk of approach to the former seems high and the chance of a harmless interaction with it seems low. Yet the measured distance between the subordinate and the other two birds is equal (5 m).

Wickler (1976) believes that behaviour associated with pair bonds not only serves to keep the metric distance between pairs constant, but also functions to maintain high accessibility between members of pairs. In the present study, the metric distance between presumably paired birds B and C deserves comment in light of this point. Following Wilson's (1975) argument, mentioned earlier, the dominant bird (B) should have had the greatest accessibility to a mate. This accessibility persisted through time not only because of this male's active spacing behaviour in relation to a female, C, but also as a result of his assertions of dominance during agonistic encounters with other males. Such displays probably improved his accessibility to C, the female, and decreased other males' access to her.

CONCLUSIONS

Spacing behaviour, unlike agonistic encounters, occurs constantly and its consequences are easily quantified. At present, no methods designed to measure overall accessibility (in the sense of Wickler 1976) are available. Proximity, albeit only one component of accessibility, seems to be a useful predictor of social organization (Fairbanks 1976). However, since the spacing patterns of free-living Silvereyes are relatively unstudied, a field investigation would be a useful test of the generality of the results described here.

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ROOSTING OF A WHITE-THROATED NEEDLETAIL

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On 18th December, 1974, we were bird-watching in the Mt Cootha Reserve at a point approximately 0.7 km west-south-west of One Tree Hill. This point lies at the western end of a spur running south from the Taylor Range between Constitution and One Tree Hills. To the south and west are steep slopes and to the north a deep gully. The weather was fine and in Brisbane at 1900 hrs the temperature was 23 degrees C, humidity 53% with a 4 knot east-south-easterly breeze and about 1/8 light cloud.

Upon our arrival at 1855, 15 minutes after sunset, we were surprised to see a White-throated Needletail *Hirundapus caudacutus* flying amongst the trees. After a brief approach from the west it was seen to fly up and briefly cling to foliage, about 10 m above the ground, on the western side of a Eucalypt about 16 m tall and 10 m west of our position. This tree was rather spindly, but had a small crown of very dense foliage at the extreme top, this crown being one of the highest points in the immediate vicinity. During the next 10 minutes the swift was seen flying nearby, generally following a roughly circular course around us. In that period, it made a further eight approaches to the trees, four of them resulting in it striking the same group of leaves that we had first seen it cling to. It also made three approaches to a large Eucalypt 8m north of the first tree, but only contacted foliage once. Yet another Eucalypt, 12 m east of the first was approached and struck on one occasion.

Each approach was from the west, and consisted of a short flight through open space and then trees. The swift did not appear to slow its flight until just before striking the foliage, when it suddenly swooped upward, thus landing upright with the body axis vertical. At no time did it fold its wings, in fact it fluttered continuously while clinging. It once held on for about a second, but usually for much less time. It always struck the trees at about two-thirds of their height.

At 1905, the swift, after an absence of about one minute, reappeared and flew towards the first mentioned Eucalypt. The light by then was so poor that we were uncertain whether it kept flying, or landed in the tree. A search by torchlight located the red reflection of an eye in the dense crown at the top of the tree. Using binoculars, it was possible to see an area of pure white below the eye, but we could not even be sure we were watching a bird. At 2000, we obtained a 30 watt spotlight. Most of the time the animal was not visible at all due to the thickness of the foliage. It was not until 2025 that we obtained clearer views as the wind parted the leaves. For about one minute, with the aid of 7x50 binoculars, we saw the animal clearly enough to be certain that it was a Needletail. The short beak, dark head, broad white throat patch, dark belly and wings and pale brown back were all seen. It was impossible to determine how the bird was perched, but its body was in an upright position. There is no reason to doubt that this was the swift we had watched earlier, and at no time was there any suggestion that more than one swift was in the vicinity.

DISCUSSION

The White-throated Needletail has apparently never been recorded roosting in its wintering grounds. Nevertheless, observations at Mt Dandenong (Victoria) by members of the Swift Survey Group suggest that the species may normally roost arboreally, a view that our observation strongly supports. On several occasions, they have witnessed flocks of Needletails, hawking low in the late evening, suddenly disappear towards the trees (Ken Simpson, *pers. comm.*).

There is no reason to suspect that the swift we watched experienced any difficulty in effecting a landfall although the reason for the initial approaches to and grasping of foliage must remain a mystery. None of the earlier landing sites were well suited to roosting as the foliage in each case was very spindly and would have afforded the bird no protection from attack by owls. In contrast, the roosting site evenutally chosen seemed ideal. The final landing was effected in extremely low light, yet there is every reason to believe the swift flew straight to its roost. We know it remained in the same position for at least 87 minutes.

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FOOD ITEM OF THE BLACK BUTCHERBIRD

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Reader's Digest (1976) listed the food items of the Black Butcherbird *Cracticus quoyi* as small birds and their eggs, insects, crustaceans, occasional reptiles, frogs and fruit.

On 24 November 1980 at the crossing of Cooper's Creek *ca* 40 km N of Mossman, we observed from 30 metres an adult Black Butcherbird on a dirt track feeding on the carcass of a Red-necked Crake *Rallina tricolor*. As we approached, the Butcherbird unsuccessfully attempted to fly away with the Crake in its claws but eventually retreated to nearby trees leaving the Crake behind. While we examined the Crake, the Butcherbird did, however, make one further attempt to retrieve it.

The skin and skeleton of the Crake remained. Its tail, intestines and other viscera had been removed through a large hole in the abdomen. Presumably, the Butcherbird killed the Crake and ate its organs. (The Crake was not on the track on the previous day when we passed the same spot). We collected the Crake and prepared it as a study skin. It is now lodged in the South Australian Museum (reg. no. B33770). Its bill at the time of collection was noted as being 'luminous green', this possibly indicating that the Crake was in breeding condition (see Mason *et. al.* 1981).

Hobbs (1981) described a Grey Butcherbird *Cracticus torauatus* attacking and killing a Painted Button-Quail *Turnix varia*. He suggested that the relatively wide, flat back of the Button-Quail may provide a suitable 'platform' upon which a Butcherbird could strike. Presumably, this would also apply in the case of a rail such as the Red-necked Crake and indeed in other largely terrestrial species. Hobbs (1981) further noted that the Button-Quail's abdomen had been torn open slightly by the Butcherbird. Thus, the mode of feeding on birds by making a hole in the abdomen appears to be common to both the Grey and Black Butcherbirds. However, we noted no signs of an attack to the Crake's head, Hobbs (1981) having observed the Grey Butcherbird strike two blows to the head of the Painted Button-Quail.

The ratios of the body lengths of the Black Butcherbird to the Red-necked Crake on one hand and of the Grey Butcherbird to the Painted Button-Quail on the other are similar, being 1.48 and 1.5 respectively (measurements from Reader's Digest 1976).

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A FURTHER POPULATION OF THE GREY GRASSWREN

LEO JOSEPH

INTRODUCTION

Following the discovery of the Grey Grasswren *Amytornis barbatus* in the Bulloo Overflow of far northern New South WAles and southern Queensland (Favaloro and McEvey 1968, Storr 1973) the species was recorded in north-eastern South Australia at Goyder's Lagoon by Cox (1976) and at Embarka WH on Cooper Creek and near the junction of The Kallakoopah and the Warburton River by May (1982). There are also unconfirmed reports of the species from Lake Cuddapan and Farrar's Creek in south-western Queensland (Schodde 1982). In this note, I record a further population in far south-western Queensland.

GREY GRASSWRENS ON GLENGYLE STATION

On 25 August 1982, and again on 13 October, I found *A. barbatus* singly and in pairs on the edge of very dense lignum *Muehlenbeckia* sp., which bordered the Birdsville - Bedourie road, in the then dry overflow area between lakes Machattie and Koolivoo. This locality, on Eyre Creek on Glengyle station, is 117 km north of Birdsville and 18 km south of Glengyle HS. On 14 October 1982 another pair of *A. barbatus* was seen nine kilometres west of the above locality, again at the edge of very dense lignum. I saw at least three different individuals on the first occasion and heard others. I had a clear view of two perched atop a lignum clump: on each, a black band ran from the lores through the eye to the occipital region and a second black band curled below and behind the eye to join a third transverse black bar on the side of the throat. These markings and their long brownish tails confirmed identification of the birds as *A. barbatus*.

A call given constantly for several minutes on 25 August was a series of three or four high-pitched, metallic ringing notes, not as 'electric' in quality as those of the Striated Grasswren *A. striatus* with which I am familiar. Once, I heard a previously undescribed call, *pit - choo*, the second syllable descending quickly and both uttered rapidly. I heard both of these calls from *A. barbatus* in the Bulloo Overflow on 22 August 1982.

The Glengyle birds were all rather confiding and easily attracted to the outer parts of lignum clumps by the squeaking noises I made. I saw some individuals hopping along from clump to clump of lignum. Some flew quickly to the shelter of lignum when flushed from shrubby, open areas between clumps.

DISCUSSION

Eyre Creek, when flowing after rainfall, can spread and fill Lakes Machattie, Koolivoo and Mipia, before continuing its course to

South Australia. Around and between these lakes is an overflow area of several hundred square kilometres covered with dense lignum. Where I found the grasswrens, the lignum was impenetrable to an observer, except along its southern edge where it adjoins open samphire and along the Birdsville - Bedourie Road. On 13-14 October 1982, I searched unsuccessfully for *A. barbatus* to a point approximately 80 km west of Glengyle HS, finding mostly sparsely scattered lignum which is apparently unsuitable for the birds pers. obs., Schodde 1982). I did not find the species in the three small areas of denser, though penetrable, lignum which I briefly searched. Thus, the population appears on present knowledge to be confined to the overflow of Lakes Machattie, Koolivoo and Mipia.

Swamp Canegrass *Eragrostris australasica*, a plant noted in the habitat of the Bulloo Overflow population of *A. barbatus* (Favaloro and McEvey 1968) and only sparingly in that of the Goyder's Lagoon birds (Schodde 1982, *pace* Cox 1976) is apparently altogether absent from the lignum plains at Glengyle. (It was also absent from the habitat of *A. barbatus* I saw in the Bulloo Overflow on 22 August 1982). The only other plants I noted in the bahitat of the Glengyle birds were a semi-prostrate lilac-flowering shrub, a composite approximately 30 cm in height and scattered, spindly trees (? *Acacia* sp.) several metres in height.

The Glengyle population is *ca* 190 km north of the nearest known occurrence of *A. barbatus*, that at Goyder's Lagoon. It is *ca* 600 km north-west of the only other *confirmed* Queensland occurrence in the Bulloo Overflow (but note other reports mentioned in Slater 1978 and Schodde 1982). Morphological and genetic studies of *A. barbatus* could be most interesting, for the species appears to be composed of at least three isolated populations: one in the Bulloo Overflow, one, perhaps more in the Cooper Creek - Warburton region of South Australia and Queensland and that reported here along Eyre Creek. Within these areas, the species' habitat is itself rather disjunct, occurring in tracts of varying area separated from each other by sandhill and gibber deserts and open lignum. So, the main populations of *A. barbatus* may be further split into sub-populations between which there is possibly little or no gene-flow. Schodde (1982) has already drawn attention to a possible size difference between the Bulloo Overflow and Goyder's Lagoon populations. Clearly, much remains to be learned of the species' distribution in north-eastern South Australia and south-western Queensland.

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UNUSUAL BATHING BEHAVIOUR IN THE FIGBIRD

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Each year, a party of Figbirds *Sphecotheres viridis* comes to feed on the ripe fruits of a White Cedar *Melia azedarach var. australasica* in my Caloundra garden. They proceed to systematically strip the tree until it is quite bare of fruit, frequently hanging in a head-down position to reach the fruits at the end of slender twigs. They also feed sporadically on the ripe fruits of an Umbrella Tree *Schefflera actinophyllos*, but do not strip it.

On the 29th of May 1982, some eighty Figbirds were feeding noisly on the Cedar when a sudden squall occurred. As the rain increased, first one, then another of the birds swung forward on its perch until it was hanging upside-down. In this position, the body was held horizontally, with head and tail hanging down. The inversion was maintained for up to 1½ minutes before the bird regained its normal stance by completing the circumference of a circle.

At least four individuals, of both sexes, were involved in this behaviour during a period of fifteen minutes, repeating the action each time the downpour intensified. One bird circled its perch three times in succession without a break, before hanging upside-down. Although thoroughly soaked, they did not stop to preen afterwards, but resumed feeding.

Since they are quite acrobatic in their feeding behaviour, this unusual type of shower-bathing may represent a modification of feeding technique.

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