

A note on the social behaviour of rehabilitating wild Barn Owls (*Tyto alba*)

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The social behaviour of wild Barn owls (*Tyto alba*) was studied in captivity during rehabilitation before their release back into the wild. The birds showed several kinds of interactions, but none very aggressive. The introduction of a strange Barn owl did not cause an increase in aggression, but rather a more complex system of behaviour interactions. The behaviour patterns displayed suggest that this species possesses an "avoidance order" rather than a "dominance order". The evolutionary implications of such social structure, possibly derived from a more sociable ancestor, are discussed.

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1. Introduction

Studies on the social behaviour of the Barn owl (*Tyto alba*) are scarce in the literature. Close monitoring of Barn owls in the wild is laborious and perhaps, because of this, most of the studies dealing with the social behaviour of this species have been carried out in captivity (e.g. Harrison 1965, 1969; Trollope 1971). Other aspects of inter-individual behaviour of Barn owls studied in the wild mainly refer to the breeding cycle, such as pair bonding and raising of young, with little information on the social behaviour (Bunn et al. 1982; Cramp 1985; Marti 1989).

This paper deals with a description of intraspecific patterns of behaviour in wild Barn owls in captive conditions in order to increase our knowledge of the social behaviour of the species. In fact, at the Raptor Rehabilitation Centre (RRC) of Parma (Italy) many individu-

als can be kept routinely in the same pen during the rehabilitation period without particular problems of husbandry. This is surprising since the Barn owl is an essentially territorial species. Nevertheless, the high density of birds that is sometimes found in the pens does not appear to be detrimental to the rehabilitation success itself. The high density is often a necessity due to the high number of owls of several species arriving and the consequent lack of suitable space for them.

We then wanted to investigate how those birds cope with the clearly unnatural context and which type of behaviour strategy and social structure they develop for a peaceful cohabitation with particular attention to the possible changes in behaviour when a strange individual is inserted in the group. In addition, we noted from the literature that some displays have been interpreted differently by different workers. Hence, us-

ing the transition analysis of the behaviour patterns we intended to find a more objective interpretation of them and of their motivation.

2. Material and methods

The study was carried out on six wild captive Barn owls (4 adults and 2 young) housed at the Raptor Rehabilitation Centre (RRC) managed in Parma by the Italian Society for the Protection of Birds (LIPU). The owls present at the RRC were recovering from various types of injuries (poaching, accident, etc.). Nevertheless, those used in this study had fully recovered and their behaviour, such as flight and general activity, was normal. Hence, they were in perfect conditions and, in fact, were ready for release in the wild.

The sex of the adults was not taken into account, as no reliable method of sexing was found in the literature (Cramp 1985). They were individually recognized by coloured plastic rings. Some other owls of different species but similar in size were housed in the pen: 11 Tawny owls (*Strix aluco*), 2 Long-eared owls (*Asio otus*), and 2 Short-eared owls (*Asio flammeus*).

The Barn owls had already settled down, for they had been housed together for 35 days before the start of the study. The birds were kept in a pen (approximately 4.60 x 4.60 m in size) with concrete floor and provided with three perches inserted obliquely in the pen sides at 1.80 m height. The owls were observed from a blind, fully lined with black sound-absorbing material, at the entrance door. The opening was covered by a thin plastic net (1 mm mesh). The birds were fed twice daily with one chicken carcass per bird, put on a plat-

form (0.73 m in size) located in the middle of the pen. Two open barred windows (0.95 x 1.15 m) were located at the rear side of the pen. A red lamp (100 Watts) was used to identify the birds and observe their activity.

The frequency of interaction and the identity of the birds involved were considered as well as the type of the behaviour patterns displayed. These were as follows: APPROACH (AP)(the close approach to a penmate causing a response, but without a contact between them); DISPLACEMENT (DI)(a bird perches close to another and pushes it with the body, hitting with the flank or wing strikes); THREATENING (TH)(the approach to an individual with a jump or a quick walk, or with a stretching out of the neck emphasizing the bill; the latter pattern was sometimes recorded also while standing, Fig. 1); PHYSICAL-CONTACT (PC)(the close approach to a penmate with a contact between them); ALLOPREENING (AL)(the bill is rubbed against the feathers of another individual); BILL-BILL interaction (BB)(a reciprocal contact with the bills, Fig. 2); AGGRESSION (AG)(striking an opponent bird with the bill or grasping it at the head or neck with the leg, Fig. 3); NO-REACTION (NR)(self-explaining); RETREAT (RE)(the withdrawal from an approaching or interacting penmate).

The whole experiment was carried out from mid-autumn to the end of winter to avoid disturbing effects arising from the reproductive period. The observation sessions lasted 120 min., starting one hour before sunrise and sunset respectively. The starting time was then varied according to their exact moment in every day. The birds were observed for a total of 60 hours, equally divided between the

Fig. 1: The threatening posture, with stretching out of the neck and emphasizing the bill.

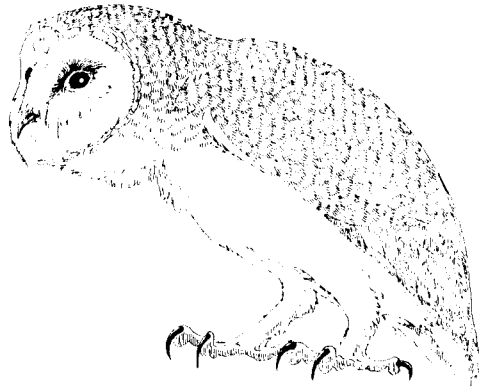


Fig. 2: The rubbing phase of the Bill-Bill interaction.



Fig. 3: The aggression by grasping the opponent with the foot.



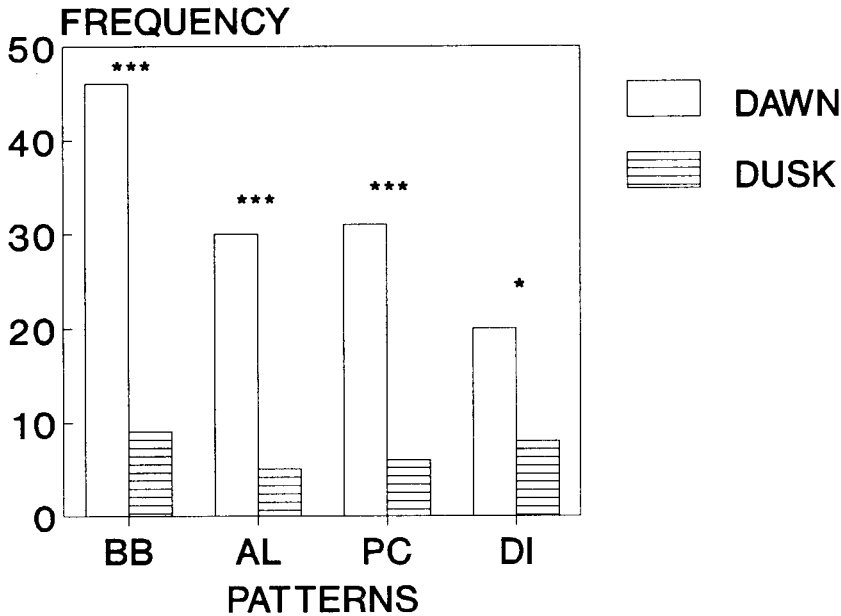


Fig. 4: The observed frequency of several patterns recorded at dawn or dusk during the first group of observations. Only the patterns with significant differences are shown. * = $p < 0.05$; *** = $p < 0.001$.

sunrise and sunset periods. A constant frequency of two daily sessions was maintained for the whole experiment.

Each bird was then tested in individual predatory tests with a live prey (a laboratory mouse with Agouti phenotype). The tests were carried out in the same enclosure and with the same procedure as described elsewhere (Csermely et al. 1989, 1991).

A second period of observations was then carried out with the same procedure as the previous one. It started immediately after inserting in the pen containing all the above birds, a strange adult Barn owl which had been at the RRC for 110 days, but had never been in contact with the other conspecifics. An additional 40 hours of observation were conducted, again equally divided between dawn and dusk sessions.

The statistics performed for the behaviour analysis were the Wilcoxon

Signed Ranks Test (Siegel 1956), the Chi-square test and the Chi-square component z value, following the method described by Bishop et al. (1975). The latter method was used for analyzing the transitions between the behaviour patterns and, to our knowledge, was not applied in previous studies on these birds. It can be very useful for giving a clearer insight into the motivation of the displays performed by the owls.

3. Results

In the first set of observations, a total of 202 interactions were recorded, involving all the Barn owls at least once. The mean frequency of interaction/bird/hour was very low (0.71 ± 0.21 SE). Some patterns were performed more often (χ^2 test) at dawn than at dusk (Fig. 4), particularly those with a typical social

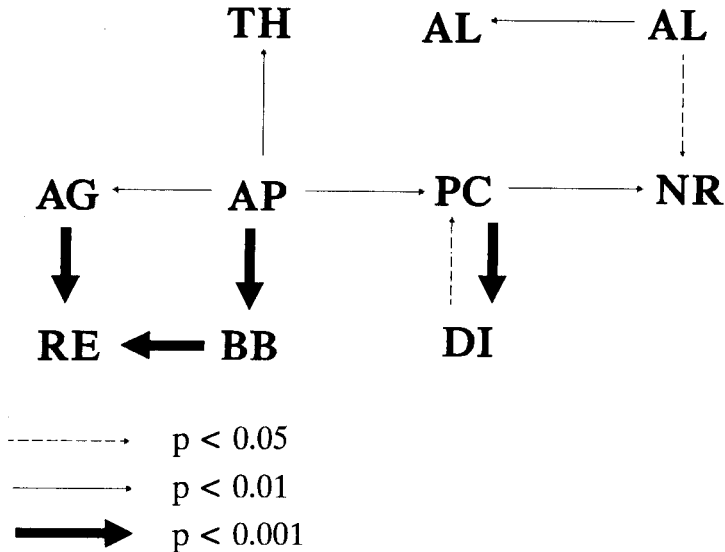


Fig. 5: The flow chart for the transitions of behaviour patterns recorded during the first group of observations using the Chi-square component z value. AP: Approach; DI: Displacement; TH: Threatening; PC: Physical-Contact; AL: Allopreening; BB: Bill-Bill interaction; AG: Aggression; NR: No-Reaction; RE: Retreat.

motivation, such as BILL-BILL interaction and ALLOPREENING. The behaviour patterns considered were not performed randomly by the birds initiating the interaction ($\chi^2 = 61.211$, $df = 6$, $p < 0.001$). They performed more often than expected (χ^2 component z value) ALLOPREENING ($p < 0.05$), PHYSICAL-CONTACT ($p < 0.05$), and BILL-BILL interaction ($p < 0.001$). The same occurred for the birds that were approached by the initiating ones; they performed mostly RETREAT ($p < 0.05$) and above all NO-REACTION ($p < 0.001$). AGGRESSION was rarely recorded (13 [6.44%] interactions performed either by the initiator or by the receiver).

Again, the observed frequencies for the behaviour response given by the approached individuals differed greatly ($\chi^2 = 275.537$, $df = 7$, $p < 0.001$). The behaviour transitions recorded were com-

pared to their expected ones using the χ^2 component z value and are shown in Fig. 5. All the patterns are connected with each other and most of them are connected with APPROACH.

The analysis of the feeding behaviour did not reveal any order between the Barn owls concerning the visits on the platform whether collecting a chicken or not. In fact, although they landed repeatedly there after the chicken carcasses were put onto it, they did not always take the "prey". Two birds only (NN and -N) scored a significantly higher frequency of visits to the platform collecting the chicken ($p < 0.01$ and $p < 0.05$ respectively, χ^2 test). They performed most of the recorded BILL-BILL interactions and PHYSICAL-CONTACT, but at the same time they received most of DISPLACEMENT, PHYSICAL-CONTACT, and ALLOPREENING. Those two birds were also successful in catching a live mouse dur-

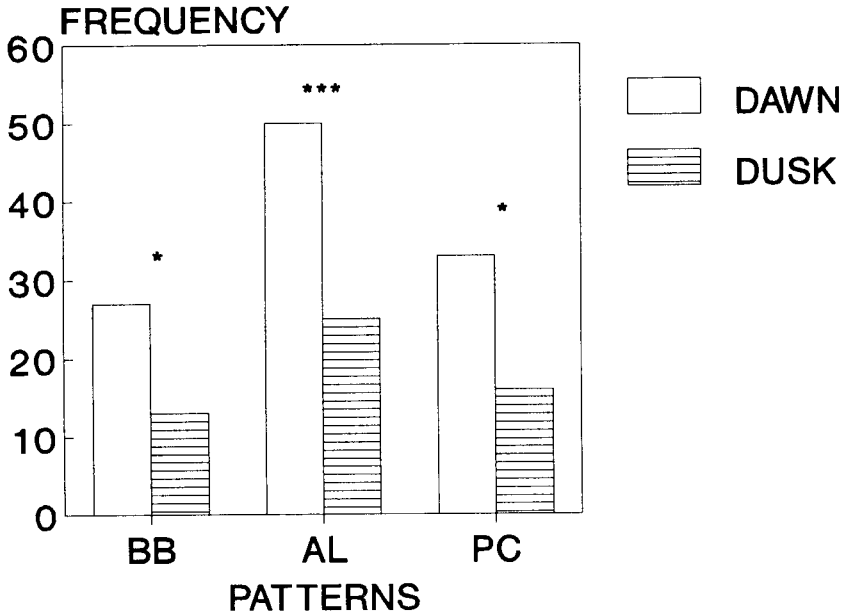


Fig. 6: The observed frequency of several patterns recorded at dawn or dusk during the observations after the insertion of the strange Barn owl. Only the patterns with significant differences are shown. * = $p < 0.05$; *** = $p < 0.001$.

ing the individual predatory tests. This was not so for all the others, not because failed or were not able, but simply because they refused to prey.

Even in the second set of observations, i.e. after the introduction of a strange Barn owl (2N), all the birds interacted reciprocally at least once. A total of 309 interactions were recorded, with a mean frequency/bird/hour just a little higher than in the previous phase (1.11 ± 0.26 SE, $p > 0.1$). Once again, as described above BILL-BILL interactions, ALLOPREENING, PHYSICAL-CONTACT, but not DISPLACEMENT were recorded more often at dawn than at dusk (Fig. 6). The use of the patterns was not random ($\chi^2 = 49.362$, $df = 6$, $p < 0.001$) during the interactions. The initiating birds displayed ALLOPREENING and DISPLACEMENT more often than expected ($p < 0.001$ and

$p < 0.01$ respectively, χ^2 component z value). On the other hand, in response, the receiver birds did not display the patterns considered with the same frequency ($\chi^2 = 532.243$, $df = 7$, $p < 0.001$). They used again mostly RETREAT ($p < 0.05$) and NO-REACTION ($p < 0.001$).

The behaviour transitions recorded with a significant frequency were almost similar to those recorded in the first observations (Fig. 7). Apart from the partial different visual aspect of this Figure from Figure 5, the several patterns have similar connections. During the second one we note that BILL-BILL interaction was not displayed more particularly by the approaching animal, but was just a response to APPROACH and AGGRESSION. Besides, RETREAT was no more caused by BILL-BILL interaction, than by THREATENING and

PHYSICAL-CONTACT, together with AGGRESSION as previously. Finally, ALLOPREENING was not performed almost exclusively as a reciprocal pattern, as observed in the first period, but was strongly elicited by APPROACH and in turn caused NO-REACTION.

The newly introduced Barn owl interacted with all the others. Mainly it was allopreened (28.0% of all recordings) and displaced (23.7% of recordings). That bird displayed the patterns without any particular preference and did not interact preferably with any other Barn owl.

Even after the introduction of a strange individual it was not possible to detect a particular order among the birds concerning the approach to the platform during the periods when the chickens were available. When landing on the platform they took the chickens

less often than during the first observation period ($z = -2.02$, $p < 0.05$, Wilcoxon Signed Ranks Test). Only the newly introduced Barn owl showed a significantly higher frequency of visits collecting the chicken ($\chi^2 = 6.545$, $p < 0.025$).

4. Discussion

The Barn owl seems then to be a species well adapted to living in groups, even when kept at high density. The interactions tend to occur mostly at dawn, i.e. at the end of the major period of activity, suggesting a similarity with the roosting behaviour of many diurnal species. It is possible that most interactions have a motivation for reciprocal recognition and renewal of the reciprocal social rank among the group. In fact, they occur

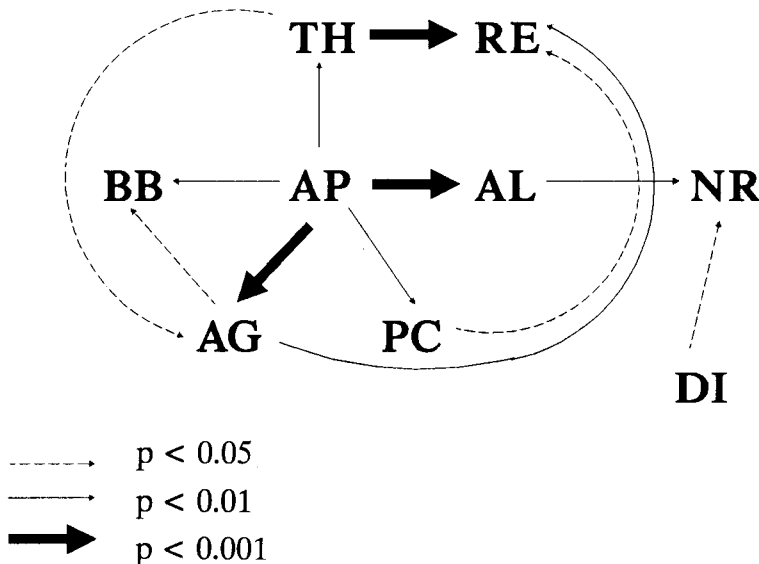


Fig. 7: The flow chart for the transitions of behaviour patterns recorded during the observations after the insertion of the strange Barn owl using the Chi-square component z value. AP: Approach; DI: Displacement; TH: Threatening; PC: Physical-Contact; AL: Allopreening; BB: Bill-Bill interaction; AG: Aggression; NR: No-Reaction; RE: Retreat.

above all, i.e. with higher frequency, at dawn when, after a prolonged period of activity, the birds come to roost together before the sleeping period. In a natural context the activity would cause the dispersion of birds, which regroup again before resting. Their habit to rest at close contact with each other suggests also that they can have preferred penmates among the group.

The patterns displayed by the birds initiating the interactions are rarely aggressive. In fact, ALLOPREENING, BILL-BILL interactions, and PHYSICAL-CONTACT entail a contact between two individuals, but do not necessarily entail a preceding attack. The BILL-BILL interaction was recorded much more commonly than AGGRESSION. We believe that it is likely either a trial of strength or a means of individual recognition, thus to be allocated among the social, or at least dominance, behaviours. In fact it is performed rarely as a reciprocal pattern but generally as response to a close approach by a penmate. The BILL-BILL interaction resembles what Trollope (1971) quoted as "bill fencing", who nevertheless considered it as a form of play among the owlets or "inefficient aggression". On the other hand, we do not believe that the interpretation given by Bunn et al. (1982), who described it as a "ritualized feeding" used as "appeasement gesture", fits our data completely. Possibly it derived from the feeding context, but it is not used for placating the opponent aggression.

ALLOPREENING is a well-known behaviour and has been recorded both in the wild and in captivity (reviews by Harrison 1965, 1969; Forsman and Wight 1979). It has been particularly associated with sexual behaviour (Martin 1974; Smith et al. 1982; Cramp 1985)

and with agonistic behaviour in general (Harrison 1965; Forsman and Wight 1979). From our data we believe that ALLOPREENING is related to the agonistic behaviour, as already hypothesized by Forsman and Wight (1979); in particular it has a great importance in reciprocal recognition, maybe for rank establishment. We confirm that ALLOPREENING, in addition to being silent, was sometimes performed in a very "exaggerated" form, as observed by Trollope (1971). It must also be noted that ALLOPREENING was infrequently performed reciprocally, as instead one would expect if it is not part of agonistic behaviour.

In addition, the approached Barn owl did not respond aggressively, but just with a retreat or with no reply at all. The reluctance to use aggressive patterns is shown also by the virtual absence of increase in the frequency of interaction following the introduction of a strange conspecific. They continue to maintain the same level of activity and display the same patterns as before such an introduction. Only the increase in number of behaviour transition types shows that the new bird is being inserted into the group. Such an increase of transitions very likely shows nevertheless that some sort of social hierarchy does exist among the Barn owl group and that a rearrangement of the reciprocal ranks is in progress.

The newly introduced Barn owl was probably located low in the social hierarchy as well as birds -N and NN. In fact, they all were characterized by frequently receiving ALLOPREENING and DISPLACEMENT. Moreover, they had the strong tendency to feed directly on the platform instead of returning to the perch for the ingestion of the chicken. A high ranking Barn owl is probably de-

fending a personal portion of the perch and makes only short visits to the platform. In particular, it does not remain there for long time feeding on the chickens. Low ranking individuals, on the contrary, will remain to feed on the platform in order to receive less disturbance such as displacement, by high ranking penmates if they return to feed on the perch.

The very high use of nonaggressive patterns by both the initiating and the recipient birds shows a social system connected primarily with the avoidance of other birds rather than with the domination behaviour. We do not believe that previous injuries affecting the owls could account for their lack of aggression or dominance, since the birds were all in perfect conditions and ready for release.

From this point of view the social system of the Barn owl seems very similar to that observed in pig (*Sus scrofa*) females. Although the two species are obviously very different, this does not mean that it is not possible to find a similarity in some aspects of the social organization. Groups of captive sows display a very low aggressiveness (Csermely and Wood-Gush 1986) and their hierarchical system was defined by Jensen (1982) as "avoidance order", compared to the more common "dominance order" of many other species. In fact, the social behaviour is regulated by the submissive patterns displayed by the individual being approached by the dominant individual. As a result, the social ranks can be very easily detected just by recording the submissive postures shown by each individual.

As a support to this hypothesis there is the composition of the sows' social group. When allowed to live in the wild or at least in free-ranging conditions,

they group into 3-5 individuals, with coordinated activities, but spaced out evenly for feeding, and with very low level of aggression (Jensen and Wood-Gush 1984). This description fits very well our data on the behaviour of Barn owls, possibly also in natural conditions, although the birds are found at much lower density. Nevertheless, it is also possible to raise the hypothesis that the Barn owl was originally more sociable than today and evolved progressively towards a strictly territorial species, as we observe nowadays, maybe because of ecological or predatory pressures that led to the necessity to space out the individuals.

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Összefoglalás

Fogságban tartott gyöngybaglyok (*Tyto alba*) társas viselkedése

A sérült madarak rehabilitációjával foglalkozó "Ragadozómadár Rehabilitációs Központban" (Raptor Rehabilitation Centre, Parma, Olaszország) fogságban tartott gyöngybaglyok társas viselkedését tanulmányoztuk. A madarak már egészségesek voltak, s egy közös röpdében tartózkodtak a szabadon eresztés előtt.

A baglyok változatos viselkedésformákat mutattak, de közöttük az agresszivitás mértéke igen csekély volt. Ez feltehetőleg a csoportos élethez

történt egykori alkalmazkodásra utal, mely az evolúció során a ma megfigyelhető territorialitás felé fejlődött.

Az egyedek közötti kölcsönhatások hajnalban, tehát az aktív periódus végén voltak gyakoribbak. Egy idegen gyöngybagoly behelyezése a rőpdébe nem növelte az agresszív viselkedés gyakoriságát, helyette sokkal összetettebb viselkedésmintázatok alakultak ki. Mindezek azt sugallják, hogy a gyöngybagolynál nem "dominancia sorrend", hanem "elkerülési sorrend" alakul ki.

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