

## The Effect of Proximity on the Sharing of Vocal Mimicry in the Spotted Bowerbird, *Chlamydera maculata*

### Abstract

Spotted bowerbirds, (*Chlamydera maculata*), are known to mimic a variety of other species' calls. This investigation set out to see if male bower owners of neighbouring bowers copied more of the same calls than the owners of more distantly spaced bowers. This may suggest whether mimicry is copied from other males or if the sound environment is important in determining what is mimicked. Recordings made during observation periods will be analysed to determine the mimetic repertoire of the bower owners and these will then be statistically compared. Bowerbird vocalisations were also recorded during experimental presentations of stimuli of varying potential threats: a dove, a crow and a falcon. Analysis of the data collected is not complete, so it is not yet possible to conclude whether proximity has an effect on the sharing of vocal mimicry.

### Introduction

The work was carried out on Taunton National Park (Scientific) which is located 250km West of Rockhampton, Central Queensland. The park was established primarily to protect the endangered Bridled Nail-tail wallaby, *Onychogalea fraenata*. The reserve comprises 11,626 ha in a square block with vegetation that forms a 'complex mosaic' of *Acacia*, (largely Brigalow, *Acacia harpophylla*), and *Eucalypt* communities with a small area of softwood scrub. There are around 14 bowers on the park, spaced approximately 1km apart, and generally located under low, dense canopy (Miles and Madden, *in press*, as cited in Madden, 2001). Many of these bowers are maintained by males, (which appear to be fairly tolerant of human observation), individually identifiable by their coloured leg rings. This, together with the inaccessibility of the park to the public provides an ideal species and location on which to focus this study. All necessary permits were obtained from Queensland Parks and Wildlife Services and the University of Queensland Animal Ethics Committee.

Spotted bowerbirds are comparable in size to a song thrush and, though relatively plain in appearance, they are easily recognisable by a vivid pink nuchal crest that is erected in moments of excitement. Males construct elaborate avenues using grass and twigs in order to attract females. On Taunton these avenues were found under *Acacia*, *Carissa* and *Wilga* species. The male dabs a red-brown mixture of saliva and grass juice on the inner avenue walls (NSW website) and decorates the bower with mostly white and pale green objects. Decorations in Taunton bowers varied widely in size, shape, colour and distance from the avenue though, common to most bowers were pieces of bone, seedpods and piles of snail shells at each end of the avenue. In particular, green berries of the *Solanum* and *Eremophila* variety were seen whose number and presence within the avenue has been suggested as a good predictor of mating success (Madden, 2001). At bowers situated near houses on Taunton, man-made artefacts e.g. glass, metal and plastic were often seen. One on-going experiment throughout our study involved taking measurements of bower dimensions with decorations and placing labelled glass at each bower so that bower maintenance could be monitored throughout the breeding season. It also allowed the tracking of the stealing of decorations by other owners. When a female visits a bower, the male commences a vigorous courtship display which may or may not result in copulation.

Though most famous for its bowers, the spotted bowerbird is known to have an impressive mimetic repertoire as well as its species-specific vocalisations which include 'cat-like' hisses, 'gulps' and 'advertisement' calls. Observers have noted the mimicry of at least 12 avian species and even feral cats (Munro and Madden *in prep.*) Several hypotheses exist to explain the function of vocal mimicry in spotted bowerbirds. Firstly it may be involved in sexual display as is seen in Satin bowerbirds, *Ptilonorhynchus violaceus* (Loffredo and Borgia, 1986). This seems unlikely as during extensive observations of displays mimicry was not recorded (Munro and Madden *in prep.*). Alternatively, it may be used as inter-specific communication, in particular in predator deterrence. It has been observed that males attending bowers will often mimic predatory birds when disturbed by humans (Frith and McGuire, 1996). Mimicry could be used in interactions between male bowerbirds. Male-male competition appears to be high, with rival males stealing decorations from each other's bowers and even destroying the avenues (Madden 2001). It is possible that males are intimidating other males using mimicry of predators or that males are matching each other's calls. Song matching is observed in many songbirds and is thought to allow males to compare features like frequency or amplitude and gain from this some knowledge of the quality of, or threat posed by, their competitors. A further explanation could be that mimicry functions to attract females as a demonstration of the male's ability to accurately copy, or, as a follow up to species-specific advertisement calls. In this way the female could be guided to the location of the bower from a distance with the advertisement call and then may feel less intimidated entering the bower as she is met with heterospecific mimicry rather than aggressive male species-specific sounds. Moller (as cited in Milius, 1998) states that many aspects of sexual behaviour are actually outcomes of sexual conflict and Borgia (Loffredo and Borgia, 1986) also suggests that the evolution of the bower was driven by male aggression, so it is possible this also drove the evolution of mimicry. It might also explain why male bowerbirds mimic non-threatening and non-competitive heterospecifics such as fairy wrens.

The function of vocal mimicry in this species forms the basis of a PhD study by Rebecca Coe of Edinburgh University. The effect of proximity on mimicry sharing is just one of the many aspects being investigated in her

on-going work with spotted bowerbirds much of which is beyond the scope of this report. Song sharing may be caused by neighbouring males (bower owners within 2km of each other) learning from each other or being exposed to the same acoustic environment. The former may support the hypothesis that mimicry arises through male-male competition in that males extend their repertoire by copying older or more experienced neighbours thus increasing their mating success. The latter would suggest nothing about the function of mimicry; it would only indicate the mechanism by which mimicry occurs.

## Aims

The main aims of my project are:

- To obtain GPS positions for active bowers on Taunton so that accurate distances between them can be calculated.
- To record mimicry and other vocalisations heard at each bower during casual observations of bird behaviour and in response to presented heterospecific models.
- To analyse recordings so that types of mimicry can be identified.
- To compare mimicry performed between bowers using Avisoft, so that physical structural similarities in the calls can be highlighted.
- To statistically analyse these findings in order to determine if birds on neighbouring bowers share more mimicry than one would expect on average.

## Methodology

### 1. BOWER INVESTIGATION

Fourteen active bowers (located from previous study, Madden 2001) were visited within the study site. The front of each avenue was defined as the end which displayed the largest pile of bleached snail shells (as these were present at each bower site) and the orientation of the avenue lengthways was taken using a compass. Measurements of avenue dimension included height, width, depth and thickness of walls. The quality of the avenue was given a subjective score from 1 to 5 (1 being the lowest) depending upon the relative completeness of the walls' twig and grass components. Basic maps were drawn of the bower area which showed the relative positions of the avenue, vegetation and decorations. The maps also show the direction of North and list the number, colour and type of each decoration inside and outside the avenue. The distance from the front of the avenue to the furthest decoration to the front, back, left and right was measured and recorded. The position of the bower correct to 15m was found using GPS.

### 2. OBSERVATIONS

Observations and recordings of all vocalisations were made at each bower site using a DAT recorder and audio technica microphone. Each observation lasted two and a half hours and began and ended with a five minute recorded census of background birdsong. The time and general weather conditions were noted by the two observers who were sat with different views of the avenue (at a distance of approx. 10m) and surrounding vegetation. During the observation period any bowerbird activity and vocalisations were noted along with the time, direction from the avenue, and where possible, the identification of the bird. Heterospecific activity within 10m of the bower was also noted.

### 3. EXPERIMENT

The experimental part of his study was conducted between the 8<sup>th</sup> of September and the 15<sup>th</sup> of October 2002. Spotted bowerbird vocalizations at each bower were recorded in response to 3 mounted birds: a known predator of bowerbirds (female brown falcon *Falco bergoria*), a potential nest predator (a Torresian crow, *Corvus orru*) and a non-threatening heterospecific (a Spotted turtle dove, *Streptopelia chinensis*). As a control, the action of placing a mount in a tree was simulated. Presentations were carried out by attaching each model in a realistic pose in a tree, at a distance of 2-10m from the avenue and a height of 1-2m just before the commencement of the observation. The birds appeared undisturbed by the presence of 2 observers when placing models and when observing from a distance approximately 10m from the avenue. Each observation lasted until the model was mobbed or up to a maximum of 2hrs, during which similar recordings to the 'casual observations' were made including a check for raptors and heterospecifics every 5 minutes. Bowerbird activity was described in detail, noting the time. Vocalizations were categorised into species-specific and mimetic calls and identified where possible. Again a 5 min census of background noise was taken at the start and end of each observation.

All four stimuli were presented at each of the 14 bowers, with at least 7 days between each presentation. The order of presentations was pseudo-randomised between bowers. Recordings were made between 6am and 12pm.

## Results

### 1. BOWER INVESTIGATION

Each bower varied slightly in size, shape and quality of avenue, number, type and position of decorations and even orientation (Bower maps are available on request). Distances between bowers ranged from 1.33km to 13.95km (Table of distances and map of Taunton are available on request).

### 2. OBSERVATIONS

A variety of spotted bowerbird behaviour was noted and recorded during casual observations including many types of mimicry and species-specific calls, bower maintenance, preening, displaying and interactions with conspecifics as well as heterospecifics. It was observed that the birds were less active and less vocal during the warmer hours of the late morning.

### 3. EXPERIMENT

The response by the bowerbirds ranged from complete disregard to attempted mobbing for each model presented except the crow. The control was always ignored. Again various types of mimicry were recorded but it was often difficult, if not impossible, to decide whether the mimicry was aimed at the model. While observations and recordings are continuing and data is yet to be analysed, it cannot be confirmed exactly what responses in terms of vocalization each model was eliciting.

On one particular occasion a spotted bowerbird showed no evidence of acknowledging the falcon model until the arrival of 3 other heterospecifics; including Noisy Miners, Apostle birds and an immature Butcherbird. These birds vocalised loudly at the model, swooping and hovering near it until it was eventually knocked. During this time the bowerbird appeared to join in the hissing episode. So far very little response has been obtained after presentation of the crow and there has been only one attempted mobbing of the dove by a spotted bowerbird.

The sound recordings taken during the experiment and the casual observations have yet to be analysed and thus much of the mimicry has remained unidentified. However, mimicry of Laughing Kookaburra, Butcherbird, Whistling Kite, cats and various Honeyeaters has been noted. Once data collection is complete, Avisoft sound analysis software will be used to compare recorded mimicry with recorded heterospecific calls and mimicry between bower sites. Sonograms will be given a subjective measure of similarity by independent judges without prior knowledge of the individuals from which they are taken. With statistical analysis it will test whether neighbouring male mimicry is more similar than expected by chance.

## Discussion

Vocal mimicry was heard at all 14 bowers used in the study and, while there is still data to be analysed, it is obvious that many of the Taunton population of spotted bowerbirds are capable of mimicking a wide range of sounds including those made by predatory and non-predatory heterospecifics, feral cats and possibly even abiotic environmental sounds. It seems plausible, therefore, that they could easily copy each other's calls thus providing the opportunity for intra-specific learning. If future statistical analysis gives evidence that sharing of vocal mimicry between neighbours is higher than expected averages would predict and if it can also be shown that these neighbours are exposed to significantly different sound environments then it must be considered that these birds are copying each other's mimetic song. This could be supplemented by two people making observations at neighbouring bowers at the same time to see if calls are being matched directly. Mimicry does occur when models are present (Munro and Madden *in prep.*). Early observations suggest that the models evoke less of a response than might be expected. It could be the case that the models did not appear to the birds as they would in nature and they could be more 'believable' if moving models could be obtained and presented with playback recordings of real vocalisations.

## Acknowledgements

I gratefully acknowledge Rebecca Coe for allowing me to participate as her research assistant in her PhD study of Spotted bowerbird vocal mimicry. I must also thank her other research assistants Lisa and Fiona, Phil and Margi Dowe for providing accommodation in Australia and Anne Goldizen for the loan of mounts. My thanks also go to Queensland Parks and Wildlife Services as well as the University of Queensland Ethics Committee.

I am indebted to the support of the James Rennie Bequest without which my travel to Australia would have been impossible. This financial contribution has enabled me to undertake a unique and worthwhile opportunity from which I have learnt a great deal that will undoubtedly aid me in my academic studies.