


Basic Course in Ornithology
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Lecture -18
Vocal Mimicry in Birds

Hello everybody I am Samira Agnihotri and I study bird songs. Today, I am going to talk to you about a special phenomenon of a bird song called ‘vocal mimicry’ for the ornithology course. So, let’s dive right in.

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We are familiar with birds that mimic in captivity, such as parrots, parakeets and mynas...



<https://meber.com/pet-birds/inside-dr-pepperberg-lib-a-parrots-concept-of-same-different/>

- Insights into vocal learning and cognitive capabilities
- But, it is unclear if any of these species mimic in the wild

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We are all familiar with birds that mimic in captivity such as parrots, parakeets and mynas and did you know that none of these birds actually mimic in the wild. They are highly social animals and they have learned to mimic human speech as they do not hear other parrots in captivity around them. They hear only humans. And so, during their crucial learning period, when they are chicks, they learn to mimic human speech.

And this is a very useful tool for scientists who want to study the cognitive capabilities of birds and who want to study how they learn different things. And perhaps, one of the most famous such examples is the work of Dr Irene Pepperberg with these African Grey Parrots - the most famous

of whom was Alex. As you can see from this image and more in the video link that will be shared with you in the description.

These parrots learn to differentiate many different things such as colour shape and even count up to the number eight. And when they were asked these questions in English like for example for this image they would ask “what is different in this in these two objects” and the difference is both colour and shape and they are actually able to answer that. So, vocal mimicry of human speech by birds in captivity allows us to gain a lot of insights into how these bird brains work. But it remains unclear, if any of these species actually mimic in their natural habitat in the wild.

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Renowned mimics :

- Australian lyrebird
- Northern mockingbird
- Gold-fronted leafbird
- Magpie Robin
- Orange-headed thrush
- White-rumped shama
- Racket-tailed drongo
- Tawny Lark

The slide also features two spectrograms and two photographs. The top spectrogram is labeled 'Hill myna' and shows a series of notes with a frequency range from 0 to 10 kHz and a time range from 0:00 to 0:05. The bottom spectrogram is labeled 'Orange-headed thrush' and shows a similar pattern of notes with a frequency range from 0 to 8 kHz and a time range from 0:00 to 0:05. To the right of each spectrogram is a photograph of the corresponding bird species. The NPTEL logo is visible in the top right corner of the slide.

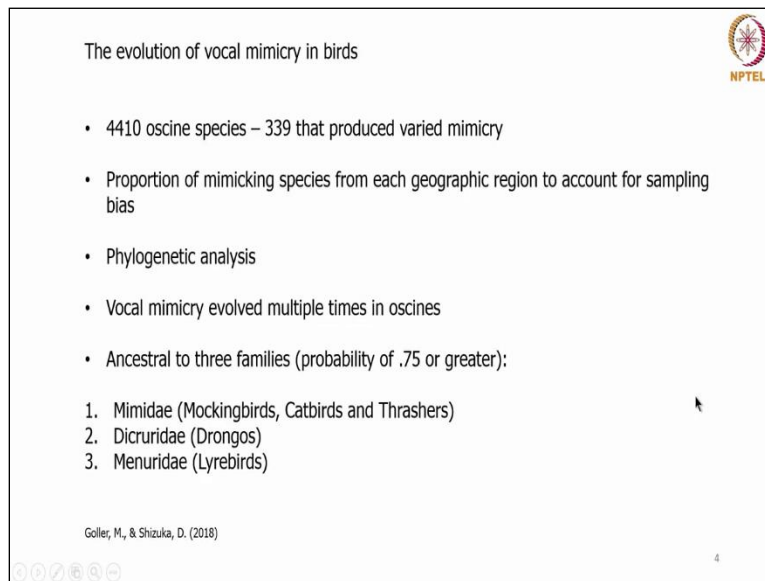
So, coming to those that do so, there are very famous mimics such as the Australian Lyrebird, the Northern Mockingbird in the U.S. And in India, we have Gold-fronted leafbird, Magpie robins, the Orange headed thrush, White-rumped Shama, Racket-tailed Drongo, Tawny Larks and many other species that mimic. And here now, I will play a few sounds for you and this image is a very crucial tool for those studying bird songs.

If you are not already familiar with it is called a spectrogram and it is a graph of the sound in frequency in hertz versus time in seconds and it allows us to view the different sounds that birds make and each sound or each individual note has a unique shape on these graphs which are called

spectrograms. So, let us listen to the call of the Hill myna. And here, let us listen to that of an Orange headed thrush.

Does that sound like mimicry? Maybe a little bit especially the first part - the descending trill as you can see from this spectrogram and the shape of the note is also similar. The first note here and the first note produced by the Orange headed thrush - the shapes are also similar. So, this is to introduce to you the concept of the spectrogram because that we will be coming using it a lot in this lecture. And to talk to you about the birds that do use vocal mimicry in the natural state in the wild.

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The evolution of vocal mimicry in birds

- 4410 oscine species – 339 that produced varied mimicry
- Proportion of mimicking species from each geographic region to account for sampling bias
- Phylogenetic analysis
- Vocal mimicry evolved multiple times in oscines
- Ancestral to three families (probability of .75 or greater):
 1. Mimidae (Mockingbirds, Catbirds and Thrashers)
 2. Dicruridae (Drongos)
 3. Menuridae (Lyrebirds)

Goller, M., & Shizuka, D. (2018)

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Now, let us take a step back and look at a study that describes the evolution of this vocal mimicry in birds in their evolutionary history. They documented data on mimicry from 4410 Oscine species from various sources of literature. Oscine species are true songbirds and of these 339 produced mimics in many different ways. So, they were true mimics. Now, the studies on bird mimicry have a bias.

There are more studies from America and UK what is called the global north. So, to account for this bias, they calculated the proportion of mimicking species from each geographic region because we know that there are lot other species that do mimic in the Southern America and in Asia and Africa but we do not have enough information on them. And then they collated this data and put

it on top of the phylogeny of birds that we have and they found that vocal mimicry has evolved multiple times in songbirds.

But, it is ancestral to three families where the probability of mimicry having evolved from the ancestor of these families was 0.75 or greater and these three families are interestingly the Mimidae which include the Mockingbirds, Catbirds and Thrashers. The Dicruridae which include Drongos and the Menuridae which include the Lyrebirds. So, this is about the history and the evolution of this phenomenon in birds.

(Video Start: 06:01)

Coming back to vocal mimicry in the wild let's take a look at this video. Did you hear any mimicry here? Maybe you heard the calls of a crow. This is a bird called the Racket tailed drongo and in this video it is partly making a call that seems to sound like that of a crow.

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So why do birds mimic in the wild?

Intraspecific functions

1. Mate attraction



Superb lyrebird

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Why do birds mimic in the wild? Now, there are two kinds of theories about this one is that there are intraspecific functions. So, birds use mimicry to communicate within their own species - to communicate something right and one example of such a function is mate attraction. So, birds might mimic use mimicry to attract mates and communicate with other individuals of their own kind of their own species.

And a famous example are the Superb Lyrebirds from Australia. Now, they have really elaborate song and dance displays. In fact, even these songs and dance even have a choreography. So, they produce certain sounds along with certain steps and this is amazing work by Anastasia Dalziell in Australia and these displays are performed by the males to attract females to their display arenas during the breeding season. And these displays also include mimicry.

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Acoustic illusions

During their final component of their song and dance display called D-song, males mimic the mobbing alarm calls of a flock of birds, including their wingbeats

This mimicry was produced:

1. When females attempted to exit display arenas
2. During their unusually long copulation

A sensory trap to deceive females to stay and mate longer?

Dalziell, A. H., Maisey, A. C., Magrath, R. D., & Welbergen, J. A. (2021)

Now, during the final component of their song and dance display called D-song males have been found to mimic the mobbing alarm calls of a flock of birds even including their wing beats. Now, mobbing is a phenomenon where a predatory bird or an animal enters nearby and all different species attack it or mob it and that is and they produce a lot of alarm calls during that time and this is what we mean by mobbing alarm calls.

So, here if you look at this graph from the paper by Dalziell et al. We can see that the male has three different types of song songs A to C are non-mimetic and this is when the male is courting the female after completing the sequence of songs A to C, it shifts to song D which is where the mobbing flock mimicry comes in and then it makes some other clicks which are non-mimetic. Now, the D song is produced primarily during their unusually long copulation.

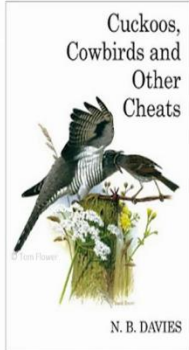

It is never produced during courtship or post copulation it was also produced sometimes when the females attempted to exit the display arenas. So, these scientists have theorized that perhaps this mobbing flock mimicry is a sensory trap to deceive females to stay and mate longer because they feel that there might be a predator around and which is why everybody is making these mobbing calls and so it is better to stay here close to the male and then the male gets mating benefits.

Why you would ask why can't the female see that there is no other no predator around? Because often during the display the male also dangles his really long tail feathers over the female. So, she can't really see very well what is going on. So, she it is possible that she can be deceived in this instance. Now there are also reports of female Lyrebirds using mimicry but we don't know what that for what function that serves and more research is needed for understanding that part.

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Heterospecific functions

1. Cuckoos and their hosts – brood parasitism



<https://www.flickr.com/photos/231063201@photostream/>

Cuckoo chicks mimic the begging calls of the host chicks, and in some species of cuckoo, one chick can sound like an entire brood

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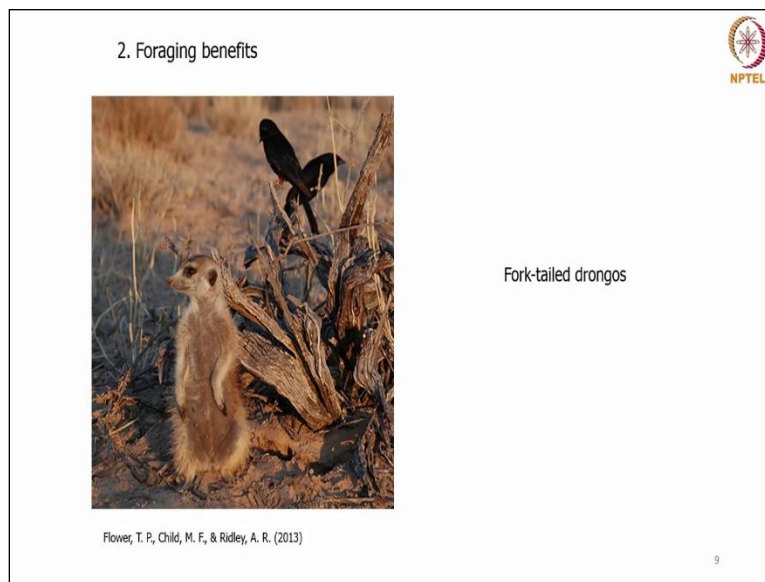
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The other kinds of functions that mimicry could have in birds are heterospecific functions. Now here the function is to the mimicry is towards other species not their own species. And here is one example so brood parasites or many cuckoos they lay their eggs in the nests of other birds and these host species and the cuckoos are in an evolutionary arms race. The cuckoo to constantly improve on ways to fool the host and reduce rejection of their chicks and the host to be able to develop ways to distinguish between its own chick and the cuckoo chick.

And in this evolutionary arms race here, you can see a Common Iora feeding the chick of a Banded bay Cuckoo. And even though it is a much bigger bird than even the adult the chick of the Cuckoo is much bigger than the adult, why do they continue to treat it as their own chick is because the many species of cuckoo chicks mimic the begging calls of the host chicks. And this stimulates the parents it is an acoustic simulation for the parents to feed their chicks and in some species of cuckoo one chick can sound like an entire brood of host chicks.

And so the stimulus for the parent to feed is so strong that it is unable to distinguish between its own chicks and that of the cuckoo and continues to feed the cuckoo's chicks and that is how this evolutionary arms race continues to go on and vocal mimicry plays an important role in facilitating the role of the brood parasite to continue with this with this brood parasitism.

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Another way in which mimicry can help interact with other species is that it could help species that mimic to gain foraging benefits. And here is when Fork-tailed Drongos from Africa come into the picture. Now this Fork-tailed Drongos are known to hang out with other creatures such as Meerkats and Pied babblers and many other species that live with it in the Kalahari desert. And it is well known to make these false alarm calls

And when it makes the false alarm calls of these other species such as if a meerkat hears a meerkat alarm call it will immediately run for cover. But it is the false one produced by the Fork-tailed

Drongo and when the meerkat run for cover, the Fork-tailed Drongo goes in and takes the food that the meerkat was trying to catch. And you can see more in the video link in the description.

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The benefits of kleptoparasitism for fork-tailed drongos

- Self-foraging versus food-thieving or kleptoparasitism
- Small insects versus larger terrestrial prey that they could not capture themselves
- Mimicry facilitates this – but “crying wolf” is a risky strategy, and they don’t do it very often
- More likely in the mornings and on cold days when self foraging does not yield much

Flower, T. P., Child, M. F., & Ridley, A. R. (2013)

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But what kind of benefits do the Fork-tailed Drongos get from this food thieving or stealing using this mimicry. Studies have shown that they gain... they are able to catch different types of prey when they when they steal food and on their own or self foraging they can only catch small insects there is a limit to the size of food that they can catch on their own. But, when they use mimicry and make false alarm calls they are able to catch much larger prey.

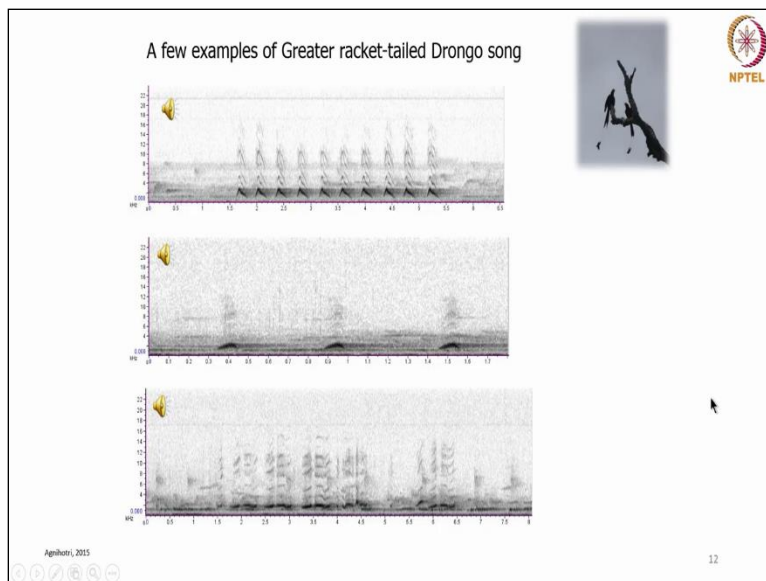
So, there is an energy benefit, there is a foraging benefit for these drongos when they use mimicry and but this is like crying wolf. It can be a risky strategy if you cry wolf way too many times and then your deception can easily be caught. And so, they do not do it very often they are more likely to do it in the mornings and on cold days when self foraging does not yield enough food for them.

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Coming close to home here in India, we have other drongos such as the Racket-tailed Drongo. And here is the sound that you heard was of a Racket-tailed drongo imitating Jungle Babblers.

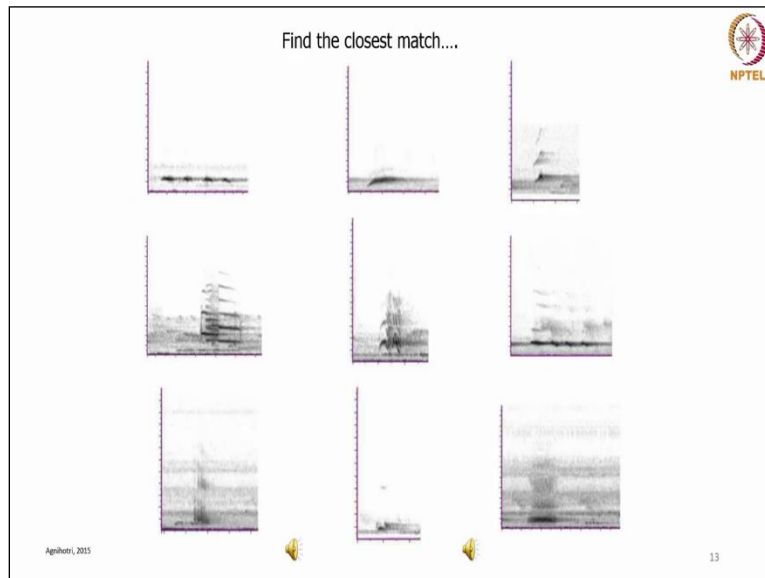
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But let me mention here that all mimics also have their own kinds of calls and notes. So, they do not only produce mimicry all the time otherwise they would not have a species identity. So, all the mimicry is interspersed with their own calls. And here, I will play you a few calls of the Racket tailed Drongo's own songs. Remember to look at the spectrogram and the notes. One more. So, as you can see the Racket-tailed Drongos also have real wide variety of their own calls and notes.

So, why do they use mimicry and how can you identify when they are using mimicry, if they have so many different varieties of calls?

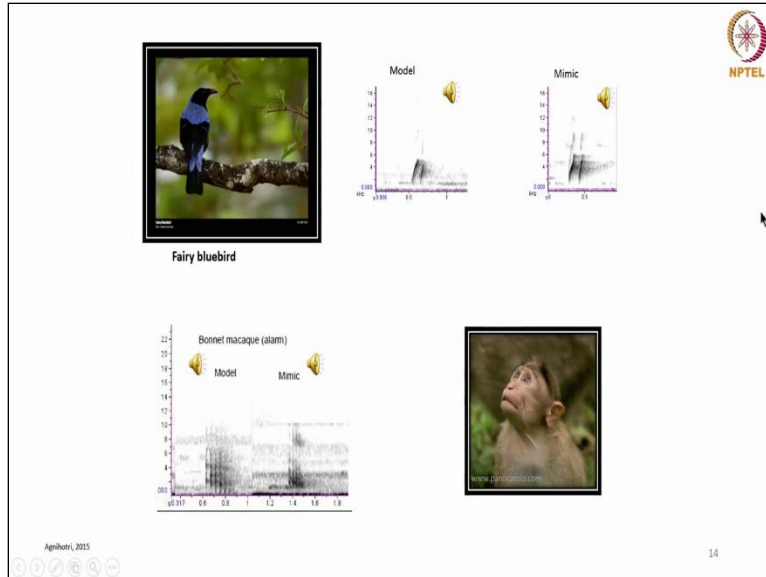
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The way to do that the way to identify what calls are mimicry and what are not are use spectrograms. So, you find the closest match. So, for example here in the first image is a spectrogram of the call of a Banded-bay Cuckoo and if you look at all the other spectrograms you will see that perhaps the closest match is this one and that is mimicry by the Racket-tailed Drongo. So, let me play both calls.

Once more. And this is the mimicry. Once more. And so, as you can see you have to record the calls of all the birds that live with the Racket-tailed Drongo and view their spectrograms and record all the Racket-tailed Drongo songs and then see how many of the Racket-tailed's songs match the songs of other species much more closely that is how you identify mimicry.

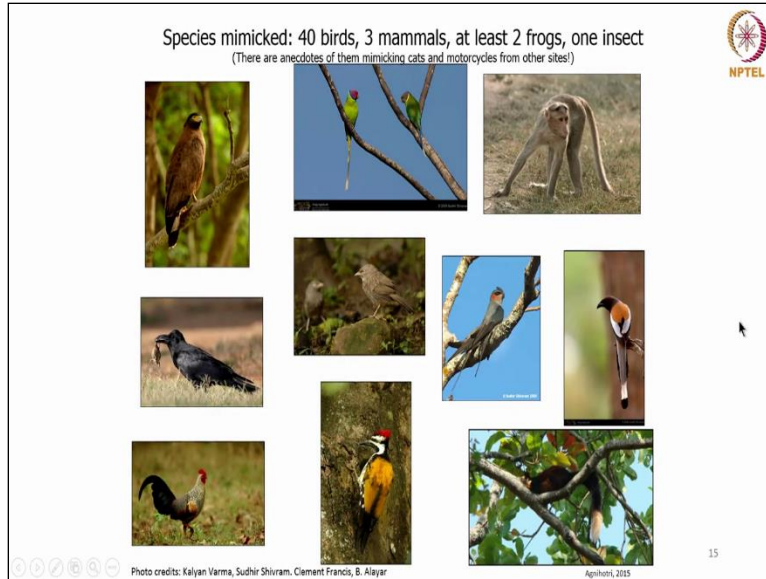
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And once you have done that you have a list of models that the Racket-tailed Drongo can mimic. And here are a couple of examples here is a Fairy bluebird and its spectrogram and call. Here is Racket-tailed Drongo producing the same Fairy bluebird mimicry. And here we have the Racket-tailed Drongo mimicking a mammal - Bonnet Macaque and its alarm call, once more. And here is Racket-tailed Drongo mimicking the macaque, once more.

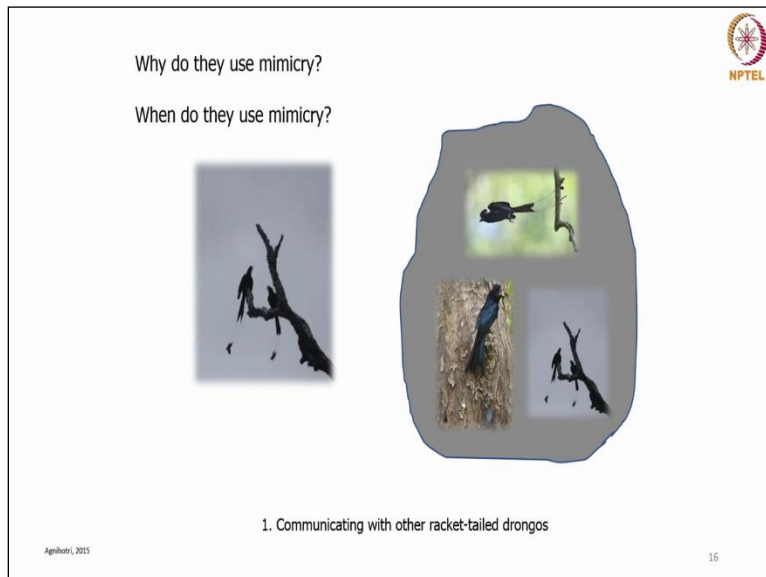
And as you can see the spectrograms of the model and the mimic are also very very similar and this is why the spectrogram is such an important tool for the study of birdsong and for identifying vocal mimicry when it occurs in the songs of species.

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So, in my study, I found that the Racket-tailed Drongos mimicked at least 40 birds, 3 mammals, frogs and insects and there are reports of them mimicking cats and motorcycles from other places where they live closer to human habitation. And this is just a snapshot of the kinds of species that the Greater Racket-tailed Drongos in South India were found to mimic. From all the way from eagles to parakeets to macaques several other birds Crows, Jungle Fowl, Woodpeckers and Giant Squirrels.

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So, why do, this Racket-tailed Drongos use mimicry? To answer that, we need to know when are they producing this mimicry when do they use this mimicry? And we found that they used this

mimicry in three different contexts - three social situations. One when they were communicating with other Racket-tailed Drongos.

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2. With other species that form mixed species flocks

3. When threatened

Agnihotri, 2015

Photo credit: KJ Tang, Thailand

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Two when they were communicating with other species that form mixed species flocks or rather when they were in mixed species flocks. And when they were threatened is the third situation when they were threatened by the presence of an eagle or another predatory bird especially when they were nesting.

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From focal animal sessions, we found that the racket-tailed drongo produced mimicry in two distinct patterns:

Song Type A

Song Type B

These two song types also differed in the sets of species that were mimicked

Agnihotri, 2015

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From following the.. the drongos in what are known as focal animal sampling sessions. We found that they produced mimicry in two distinct patterns just like the Lyrebirds. We found that the Racket-tailed Drongo's song can be divided into song type A and song type B. Let's listen to song type A. These are its own calls this first part highlighted here. Then it starts making Plum-headed Parakeet mimicry.

So, here you can see that the Racket-tailed Drongo's calls in song type A are produced in a very repetitive manner. It's repeating the same note over and over and over again until it switches to another note which is also repeated many times. In song type B, which we shall listen to now the situation is different. In song type B again, there is mimicry but it is not as repetitive as in song type A.. You can see here, there is an occasional Green Pigeon mimicry then some other species and then third species.

So, the rate of turnover of notes is very high the different species that are being mimicked are being mimicked one after the other whereas in song type A, the same note is repeated for a long time. So, there are many differences in song type A and song type B. Another difference is also in the sets of species that were mimicked. When producing song type A the species that were mimicked were very different from those that were being mimicked in song type B.

So, this brought us to the question, can there be two different functions for song type A and for song type B? And we did playback experiments to test this hypothesis.

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Playback experiments to other racket-tailed drongos:

- Song Type A with or without mimicry (repetitive notes) attracted other racket-tailed drongos – mate attraction or repelling rivals

Playback experiments to other species:

- Song Type B attracted other species, specifically the ones being mimicked in the playback – recruitment for foraging benefits

Photo credits: Clement Francis, Kuljen Varma

Agnihotri, 2015

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And we found that song type A with or without mimicry, remember with the repetitive notes attracts other Racket-tailed Drongos. That means that it could possibly have a mate attraction or a rival repulsion function, which is an intraspecific function. So, song type A is used to communicate with other Racket-tailed Drongos. Whereas, song type B attracted other species never Racket-tailed Drongos and it specifically attracted the ones being mimicked in the playback.

So, if Jungle Babblers were being mimicked in song type B, then they would approach the speaker, If Brown-cheeked Fulvetta were being mimicked, they would approach the speaker, if woodpeckers were being mimicked they would approach the speaker. This led us to the conclusion that song type B is clearly a heterospecific function. It is used to communicate with other species possibly as a recruitment function to call them towards the Drongo or to locate them

so that the drongo can gain foraging benefits. Right. Now, Racket-tailed Drongos are well known to participate in what are called mixed species flocks. These are loose aggregations of many different species that move together in one patch of the forest and they feed together. Right. And the Racket-tailed Drongos often follow species that are actively foraging in the leaf litter or in the canopy and disturbing a lot of insects.

And so they hang out with these birds just like the Fork-tailed Drongos in the Kalahari and they eat the insects that are disturbed by these birds. We do not know so far whether they use the

mimicry for kleptoparasitism like the Fork-tailed Drongos, but they definitely mimic to recruit or locate these other species as our playback experiments have shown.

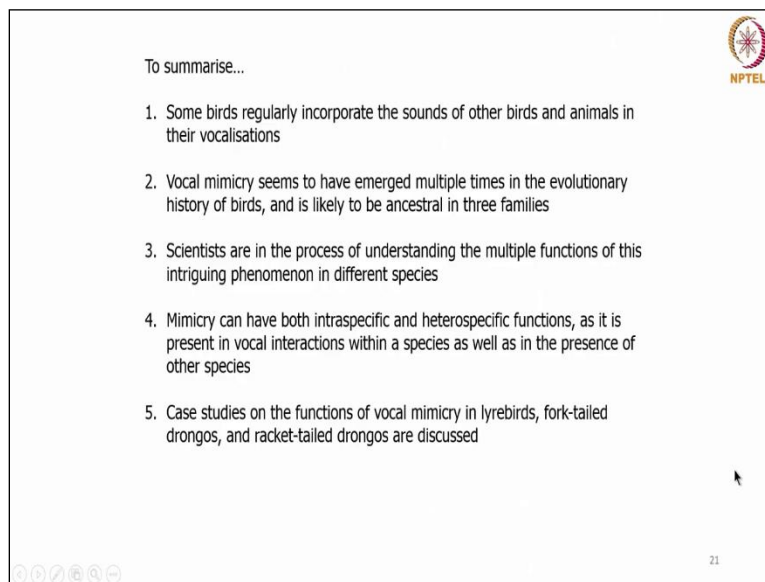
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And to show you here is a video of a Racket-tailed Drongo and a Woodpecker. So, as you saw clearly in that video, the Racket-tailed Drongo is hanging out right next to the woodpecker who is foraging for grubs in the dead branch and the Racket-tailed Drongo is not making any woodpecker mimicry right now, it is just making some small short calls. But the woodpecker seems least disturbed by its presence it seems to be ignoring the Racket-tailed Drongo.

And as soon as the woodpecker leaves the Racket-tailed Drongo bends down to see what it can forage from the hard work of the woodpecker.

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To summarise...

1. Some birds regularly incorporate the sounds of other birds and animals in their vocalisations
2. Vocal mimicry seems to have emerged multiple times in the evolutionary history of birds, and is likely to be ancestral in three families
3. Scientists are in the process of understanding the multiple functions of this intriguing phenomenon in different species
4. Mimicry can have both intraspecific and heterospecific functions, as it is present in vocal interactions within a species as well as in the presence of other species
5. Case studies on the functions of vocal mimicry in lyrebirds, fork-tailed drongos, and racket-tailed drongos are discussed

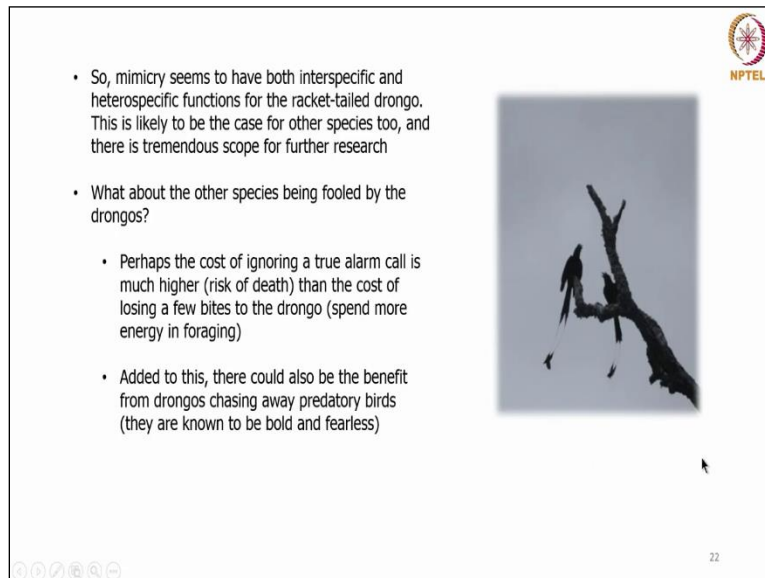
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To summarize, some birds regularly incorporate the sounds of other birds and animals in their vocalizations. Vocal mimicry seems to have emerged multiple times in the evolutionary history of birds and is likely to be ancestral in three families. Scientists are still in the process of understanding the multiple functions of this intriguing phenomenon in different species. Mimicry can have both intraspecific and heterospecific functions as it is present in vocal interactions within a species as well as in the presence of other species.

We looked at a few case studies on the functions of vocal mimicry in Lyrebirds, Fork-tailed Drongos and Racket-tailed Drongos.

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The slide contains a list of bullet points on the left and a photograph of a racket-tailed drongo on the right. The photograph shows a dark bird perched on a branch against a light sky. The slide also features an NPTEL logo in the top right corner and navigation icons in the bottom left corner.

- So, mimicry seems to have both interspecific and heterospecific functions for the racket-tailed drongo. This is likely to be the case for other species too, and there is tremendous scope for further research
- What about the other species being fooled by the drongos?
 - Perhaps the cost of ignoring a true alarm call is much higher (risk of death) than the cost of losing a few bites to the drongo (spend more energy in foraging)
 - Added to this, there could also be the benefit from drongos chasing away predatory birds (they are known to be bold and fearless)

And in the Racket-tailed Drongo, mimicry seems to have both inter-specific and heterospecific functions for the Racket-tailed Drongo. This is likely to be the case for other species too and there is tremendous scope for further research. What about the other species being fooled by the drongos you will ask. Perhaps, the cost of ignoring a true alarm call is much higher the risk of death if there is a real predator present.

Then the cost of losing a few bites to the Drongo, which is the cost of a little more energy in searching for more food is much less. Added to this there could also be the benefit from Drongos chasing away predatory birds as they are known to be bold and fearless. Thank you. Please look at the videos in the description for more information.