Vocal Communication

Class Business

Reading for this lecture

Required. Gill: Chapter 8

1. Introduction

A) ADVANTAGES OF SOUND OVER SIGHT

i) Although birds are very visual animals, there are times when it is better to communicate using sound. Sound transmits over much longer distances. Sound can be used when it is difficult to use sight, e.g., at night (owls, nightjars) or in very dense vegetation, such as marshes (rails, bitterns) or dense forest. Sound provides a way of communicating, without revealing your location.

B) THE IMPORTANCE OF VOCALIZATION VARIES AMONG BIRDS

i) Some species barely make sounds – just hiss and grunt (e.g., New World vultures, storks).

ii) But, most species use sound a lot – this is especially true among members of the order Passeriformes (the passerines or "songbirds").

C) SONGS VS. CALLS

i) The distinction between songs and calls is somewhat arbitrary.

ii) But, the term "song" is generally used to refer to longer, repetitious vocalizations that are associated with breeding (especially mate attraction and territory defense).

iii) In contrast, bird "calls" tend to be shorter, simple vocalizations that are used in a variety of other contexts (distress, warning, flock cohesion, etc.).

2. How do birds make sounds?

A) THE SYRINX

i) The basic vocal structure in birds is the **syrinx**, an anatomical feature that is unique to birds (humans make sound with their larynx – a different, though somewhat similar, structure).

ii) The syrinx lies at the base of the trachea ("windpipe"), where the two main bronchi meet and join the trachea.

iii) Sound is produced by the passage of air (from the lungs and air sacs) over the **internal tympaniform membrane**. As the air moves over this membrane, the membrane vibrates to make sounds. The nature of the sounds depends on the features of the membrane, which can be modified by syringeal muscles. This system is similar to that in a human larynx, but far more efficient at producing sound (almost all the air is used to make sound in birds, compared to ~2% in humans).

iv) The complexity of the syrinx (and thus the complexity of sounds that can be produced) varies among different types of birds. In general, passerines have more complex syrinxes than non-passerines. Within the passerines, the main taxonomic subdivision is between oscines (which have complex syrinxes and complex songs) and the suboscines (which have a more simple syrinx).

v) Some birds (both nonpasserines and passerines) can even produce two sets of sounds (two songs) at the same time. See the textbook for more on this.

B) OTHER METHODS OF SOUND PRODUCTION

i) As mentioned in earlier lectures, some birds produce sounds in other ways – e.g., modified feathers (snipe), physical actions (woodpeckers drumming), etc.

3. What do birds use sound for?

) RECOGNITION

i) Recognizing species. Most birds make sounds that are unique to their species. This makes it possible for birdwatchers to identify most species of birds simply from hearing their vocalizations. More importantly it allows the birds themselves to determine each others' species. In most cases birds have additional cues (such as plumage patterns), but sometimes different species are much more easily distinguished (at least by humans) by their sounds than by their appearance. Flycatchers in the genus *Empidonax*, for example, are among the hardest North American birds to identify by plumage, but are relatively easy to identify by their calls.

ii) Recognizing individuals. Just as you can tell your friends apart when you hear their voices over the phone, many birds can distinguish each other simply by their voice. The ability to do this varies among species and seems to depend somewhat on context. Individual recognition seems especially well developed in colonial species – where the large number of birds makes it harder to use other information. Seabird chicks (e.g., gulls) and adults (e.g., penguins) can distinguish the calls of their parents or offspring from the cacophony of the colony. This ability allows them to find each other when the adults return from sea to feed the young. Other species (e.g., tawny owls) have been shown to be able to recognize the vocalizations of their neighbors, and will respond differently to familiar calls and those of strangers. In some cases, the differences in the calls of individual birds have been used by scientists to monitor the size of a population of a rare species.

B) BREEDING

i) Territory defense. Territorial birds (usually males) use song to stake out the boundaries of their territory and ward off potential intruders. Songposts are typically located around the edge of the territory and the territory holder frequently moves between songposts.

ii) Mate attraction. Breeding songs also can be used to attract members of the opposite sex.

iii) Location. Some birds use song to advertise their physical location so that others (e.g., potential mates) can find them. In others, rather more abstract information about location can be gleaned from a song (e.g., in Chestnut-sided Warblers it is possible to tell if the bird is in the center or near the edge of its territory from the type of song that it gives).

iv) Very often a single song can convey several types of information simultaneously, so the boundaries between different song types/functions are often pretty fuzzy.

C) MANY OTHER THINGS – SEE TEXT BOOK FOR DETAILS AND EXAMPLES

4. How do they use sound to convey different messages?

A) DIFFERENT TYPES OF SOUNDS

i) Manipulation of syrinx anatomy affects the sounds produced.

ii) Some types of sounds are better for certain messages than others. Low-frequency sounds travel longer distances and are less likely to be affected by interference than higher frequencies. Consequently, they are often used by birds that occur in dense vegetation or that need to communicate over long distances. Simple sounds (e.g., whistles) tend to be less affected by the structural complexity of dense vegetation than complex songs (e.g., buzzes). Hence, many forest birds have songs that are simple whistles (e.g., northern cardinal, tufted titmouse). In contrast, complex buzz-like songs have advantages in open habitats because they are not distorted by, for example, windy conditions. Hence many grassland and open country birds (including various sparrows) have complex buzzy songs.

iii) Just to complicate things, some warblers that live in the very top of the forest canopy have complex buzzy sounds – why do you think that is? How can this observation be made to fit with the theory I just laid out?

B) SONG REPERTOIRE

i) In addition to making a variety of different types of vocalization, birds also can vary the details of each type of vocalization. Songs, in particular, can vary greatly each time they are sung. Birds can (and do) vary the sounds that make up the song, the sequence in which the sounds occur, the number of times each sound (and each sequence) is repeated, etc., etc.

ii) The size of a bird's song repertoire can be very important, because it seems to be something that has been the subject of **sexual selection** (= natural selection that affects an individual's ability to obtain mates) in some species. In these cases there has been selection for individuals that know a lot of songs: males with a large repertoire are favored by females.

iii) One way that a bird can increase its repertoire is to incorporate whatever sounds it hears in its surroundings. In some cases this can lead to amazing levels of **mimicry**. Members of the Mimidae family (e.g., mockingbirds) and the Sturnidae family (e.g., mynas) are especially well known for their ability to mimic other birds, random sounds in the environment, even human voices. For example, last spring there was a northern mockingbird on territory by the parking lot behind E. O. Smith high school that had incorporated the sounds of a car alarm (as well as the calls of several other bird species) into its song …… there's a pretty good chance he'll be there again this year if you want to go listen to him.

5. How do birds know how to sing?

A) INHERITANCE, LEARNING, AND IMPROVISATION

i) Innate knowledge appears to play a role in the development of vocalizations in all birds. In some species, vocalizations appear to be completely innate and at least somewhat fixed in their structure. Even in birds for which learning is an important component of song development, there appears to be strong genetic control over the way in which song is learnt. For example, see the discussion of song and swamp sparrows in the text book.

ii) Learning is especially important in certain groups of birds. The oscine passerines are the primary group in which songs are largely learned by listening to others, although learning is also important in both parrots and hummingbirds (two non-passerine families). The ability to learn songs is one of the major distinctions between the two suborders within the passerines (the order Passeriformes = "songbirds"). These suborders are the **suboscine passerines**, in which vocalizations are almost entirely innate, and the **oscine passerines**, in which song is largely learned. These two groups also differ in syrinx complexity (see above).

iii) Finally, some birds incorporate improvisation into their songs, varying the details and creating a unique version of a general theme. This variation is partly what birds use to distinguish among each other.

B) SONG DIALECTS.

i) Many species of oscine passerine exhibit regional variation in their songs, such that different "**dialects**" exist.

ii) There are various ideas about how these dialects form, but at least part of the explanation has to do with the fact that these birds learn their songs by listening to their neighbors. Consequently, birds are likely to learn songs that are similar to those of the birds around them. But, learning is an imperfect process (sound familiar!?) and errors occur. These errors increase over distance, especially when groups are subdivided, allowing local variations to form.

iii) Something to think about: Brown-headed cowbirds are brood parasites (which means that they lay their eggs in the nests of other bird species). Consequently, young cowbirds grow up without ever interacting with their parents or with other adult cowbirds. Yet, they not only know how to sing like cowbirds, but their songs also have distinct dialects. How do you think they acquire their songs?