

continuously and had been able to observe the curious interplay of their mutual reactions, to witness five visits of the old birds to their eyrie, and to make a long series of photographs selected as a record of successive events. There was no ringing down of the curtain. It had fallen silently and the play was over.

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MIMICRY OF VOICE IN BIRDS.¹

BY CHARLES W. TOWNSEND.

THERE are some birds that are noted for their imitations of other birds' voices—of their various call and alarm notes and of their songs. This mimicry may be conceived to be conscious or intelligent, on the one hand, or unconscious, that is mechanical, on the other, or not mimicry at all, but merely an accidental resemblance.

For example, that particular scream of the Blue Jay which resembles so closely the scream of the Red-shouldered Hawk that one can not be sure of the identity of these two birds by the voice alone, may be either an accidental resemblance or a conscious or unconscious imitation. If it occurs among Blue Jays which have never heard a Red-shouldered Hawk scream or whose associates or ancestors have never heard this scream, then we must say that the resemblance is merely accidental. Some Blue Jays breed in northern regions where Red-shouldered Hawks are unknown, but they all in migration may hear the scream of this Hawk or the mimicked cry of other Blue Jays. Hence, although it still may be an accidental imitation, it may, on the other hand, be a conscious or an unconscious one. Those who believe that beasts and birds are merely "machines in fur and feathers" would say that, if the mimicry were not accidental, it must be unconscious or mechanical. When, however, one observes a human infant endeavoring to imitate sounds, or observes a bird, after listening to

¹ Read at the Meeting of the American Ornithologists' Union in Cambridge, October 9, 1923.

another bird, repeating its notes—in both cases with increasing proficiency and apparent satisfaction with the repetitions—one can not help being struck with the similarity of these two cases, and with the appearance, to say the least, of conscious imitation in both child and bird.

Lloyd Morgan¹ makes three stages of mimicry in the development of the child: “First, the instinctive stage, where the sound which falls upon the ear is a stimulus to the motor-mechanism of sound production. Secondly, the intelligent stage of profiting by chance experience . . . If we assume that the resemblance of the sound he utters to the sounds he hears is itself a source of pleasurable satisfaction (and this certainly seems to be the case), intelligence, without the aid of any higher faculty, will secure accommodation and render imitation more and more perfect. And this appears to be the stage reached by the Mockingbird or Parrot. But the child soon goes further. He reflects upon the results he has reached.”

There is still another possibility, the inheritance of mimicked voices. Eliot Howard in his work on British Warblers says of the mimicry of the Blackcap, “There are some grounds for believing that part of the imitations may be congenital, the acquired imitations of the parent being transmitted to the offspring.”

Donald R. Dickey² reports an immature male Western Mockingbird that was “successfully ‘imitating’ the notes of the Sparrow Hawk, Killdeer, and Cactus Wren . . . The very few months which had actually elapsed since this youngster first saw light would seem to form all too short a period for the purely imitative acquisition of so varied a repertoire,” and he asks “May not generations of usage have made this ability an inherent rather than a mimetic characteristic?” But he goes even farther than this and suggests that the apparent imitations may be as much an inherent part of the song as were the true Mockingbird phrases. “In other words,” he asks, “may this not be a case of parallel ability and adventitious similarity rather than actual and individual mimicry?”

If the cases of apparent mimicry were limited in number and

¹ ‘Animal Behaviour,’ 1908, p. 193.

² ‘The Mimetic Aspect of the Mocker’s Song.’ ‘Condor,’ 1922, XXIV, p. 153.

imperfect in form, this accidental or adventitious similarity might be considered, but the very large number of perfect reproductions by Mockingbirds and by other birds renders this latter suggestion highly improbable. Mr. Dickey suggests that if the young Mockingbird "had been transplanted as a nestling to a favorable habitat on which the note of Sparrow Hawk, or Killdeer, or Cactus Wren, had never fallen, he would yet have greeted approaching maturity with 'imitations' of their songs." This is an experiment that should be tried.

An experiment exactly similar to this has been tried in this country on a large scale and it is capable of throwing much light on these subjects. The European Starling, one of the best of mimics, was first successfully introduced from Europe into this country in 1890. The period of time that has elapsed since then is certainly not enough to have permitted it to acquire by inheritance a mimicked song, neither is it long enough to have effaced the inheritance of previously inherited songs. That is to say, if the mimicry of other birds' songs has become part and parcel of the Starling's repertoire by inheritance through many generations, we should expect to find the Starling in this country repeating the songs of Old World species, and not the songs of American birds. On the other hand, if the reproduction of bird songs comes about by individual mimicry, we should find that in Europe the Starling would mimic European birds and, in America, American birds, and this is indeed the case. The evidence on a large scale provided by the Starling is of great value and, in the case of this bird at least, confutes Mr. Dickey's hypothesis.

In the following studies of mimicry, the facts seem to me to point clearly to conscious or intelligent mimicry. The assertion is sometimes made by those who have not paid serious attention to the subject that the resemblances are sometimes fanciful and more in the mind of the recorder than the facts warrant. I have endeavored to avoid this criticism by relating only striking resemblances and I believe the fanciful element is absent.

The European Starling's powers of mimicry have long been known and have been taken advantage of and developed in captivity. Dresser, in 'The Birds of Europe,' says: "As a cage bird the Starling is easily domesticated and soon learns to articulate

words and whistle tunes. Baron R. König Warthausen gives some interesting details respecting a singing and talking Starling who lived in 1582, and who sang and spoke in German and Polish and had given itself a name in the latter language."

European ornithological literature contains many references to this habit. Charles A. Witchell¹ says that "this bird is one of the best mimics, and its reproductions of the notes of other birds, and even of animals, are as exact as they are various." H. L. Saxby² says: "The Starling imitates the note or cry of almost every bird, not even excepting the Herring Gull, but its chief models seem to be the Oyster-catcher, the Redshank, the Golden Plover, the Whimbrell, and the Curlew; these it mimics so perfectly as often to deceive the most experienced ear."

Owing to the frequency with which the Starling in New England imitates the Wood Pewee, it has been suggested by more than one person that these notes may be some of its native ones, and that the mimicry, which is very perfect, is merely accidental. I, therefore, consulted Mr. Henry Mousley, who is familiar with this bird both in this country and in England. He wrote me that he had heard this imitation here but never in England, where he has heard it "imitate the following quite perfectly, viz.: Sparrow, Yellow Hammer or Yellow Bunting, Chaffinch, Robin, Curlew, Pheasant, Green Woodpecker, Jackdaw, Peewit, Golden Plover, Blackbird and Dunlin. Besides these he has been known to imitate perfectly a dog whistle, and the tinkle of a particular cycle bell, the latter so perfectly as to delude its hearers!"

I am inclined to think that individual Starlings vary greatly in their powers of mimicry. Some rarely or never mimic, while others are constantly indulging in this practice. One that I observed on an early day in April in Ipswich, imitated perfectly the call notes of the Robin, some of those of the Herring Gull, the bell-notes and scream of the Blue Jay, the call of the Cowbird, the songs of the Meadowlark and of the Wood Pewee, and the masterful call of the Greater Yellow-legs. When this last distinctive and familiar call came rolling forth, I instinctively turned and swept the marsh with my eyes, expecting to see the flashing white rump of this

¹ 'The Evolution of Bird-Song.'

² 'Birds of Shetland.'

bird, but on turning back to the Starling, I saw his raised head and moving bill which revealed the mimic. As far as I knew, the Yellow-legs had not arrived from the south; the Starling, perhaps, had left him behind in the migration.

Mr. Ralph Lawson has heard the following additional birds mimicked by the Starling: Whip-poor-will, Bob-white, Goldfinch and Black-billed Cuckoo, and Mr. Charles L. Whittle has added the Chickadee, Redwinged Blackbird, Phoebe and Crow to the list.

The Mockingbird is the best known and the most proficient mimic among our native birds. Although a bird of the south, it frequently wanders into New England. The famous "Arnold Arboretum Mockingbird," whose songs were studied for several years and described in detail by the late Mr. H. W. Wright, has been heard to imitate fifty-five different birds. On one of my visits to him, he was at his best, and, in the course of an hour, imitated twenty-one birds. His imitations of the varied notes of the Blue Jay were particularly striking, and included the harsh Jay scream and the lovely bell-notes. Whether the scream of the Red-shouldered Hawk was copied from the original or from the Blue Jay, I do not know. The alarm and call notes of the Robin were as perfect as was the cheerful, glorious song of this familiar bird. The multiple calls of the Flicker were evidently favorites of his and were introduced at frequent intervals between the longer songs. I looked for a Phoebe in the bushes until the Mockingbird sailed close over my head, uttering a perfect imitation of the Phoebe's song. The melody of the Song Sparrow was unmistakable but not perfect. It was evident the mimic needed more practice. The rattling of the Crow and of the Kingfisher, the whistle of the Bob-white, the calls of the Barn Swallow and the songs of the Baltimore Oriole, the Bluebird, the Scarlet Tanager and the Chewink, all in turn delighted my ears.

There were frequent interpolations of the harsh notes of other birds as well as those, doubtless, of his own devising, between the musical parts of the performance. The whole was in the nature of an intellectual treat, for one was constantly on the alert to detect new imitations, and there were no doubt many that I was not clever enough to recognize. This bird was an unusual one

among Mockingbirds, an expert mimic with a large repertoire which he appeared to be perfecting by practice and to which he was constantly adding. Could anyone doubt, in listening to him, that his imitations were conscious ones and that he took pleasure in them?

Dr. S. C. Brooks has related to me an interesting instance of what appears to be conscious mimicry in this Mockingbird. The bird was imitating the calls of the Killdeer, when a Sparrow Hawk flew by, and the mimic at once set up the rolling call of this Hawk.

The Brown Thrasher, a near relative of the Mockingbird, has a more continuous song and, at its best, one of great beauty and power not marred by harsh or disagreeable notes. His song consists of a series of couplets with here and there an enthusiastic triplet or even a quadruplet. It is an inventive song. He is constantly improvising, but there is often the suggestion of mimicry as the song wanders on and new phrases appear and are repeated. It is rare, however, that one can recognize the source of the mimicry. I have detected the call of the Bob-white and the melody of the Robin, the Bobolink and the Veery, but mimicry is not needed to complete the perfection of his song. He generally avoids vulgar plagiarism, but doubtless profits by the musical suggestions of other birds.

Another bird of this group and a true mimic is the Catbird. Like the Mockingbird he interlards his song with harsh and unmusical notes, often with his well known cat-like *mews*, which are sometimes short and emphatic, sometimes long drawn out and plaintive. He appears to be constantly trying some new combination of notes, and some of his improvisations are very sweet and musical. These he occasionally repeats in the manner of the Brown Thrasher, particularly when a musical phrase appears to tickle his fancy. Thus, I once heard a Catbird rolling off a delightful phrase which sounded like *Peter-boro, Peter-boro*. This he repeated five or six times, then *mewed* and tried something else. If the Catbird would suppress his love of bizarre and harsh notes, and of buffoonery and horse-play—for I suspect he has a sense of humor—and would devote himself more continually to his musical repertoire, he would rank among our best singers. He is, however, badly handicapped by his name.

In my notes I have recorded a number of birds that are mimicked by the Catbird. I have heard him imitate the Blue Jay's common scream, the whistle of the Bob-white, the calls of the Flicker, the alarm notes and song of the Robin, the call notes of the Barn Swallow and of the Goldfinch, the songs of the Rose-breasted Grosbeak, Veery, Wood Thrush and Red-eyed Vireo—although in the richness and variety of the notes the last imitation matched more closely the song of the Solitary Vireo—the couplets of the Brown Thrasher, the alarm call of the Greater Yellow-legs and the rattle of the Kingfisher. I was completely deceived at first by the Yellow-legs imitation and looked out on the marsh for the long-legged originator but soon saw the mimicking Catbird, who after a little, began to *mew* in his own proper manner. On both occasions that I heard the Kingfisher's rattle mimicked by this bird, I was close to a river, on it in one case in a canoe, and the Catbird swooped down in crossing the river so that the actions as well as the voice of the Kingfisher were imitated.

Dr. Glover M. Allen has kindly sent me for inclusion here a note on this versatile bird which illustrates and explains its methods in mimicry. He writes: "Some years ago at Newton, Mass., I made daily visits to an old marsh on the edge of an apple orchard to look for birds. A Catbird was heard singing in a certain spot on these visits and close by a Least Flycatcher had a nest and one of the birds was constantly giving its *chebec*. The Catbird was one day noticed giving a note that was so different from its usual utterances that I stopped to listen. Several times a subdued chebec-like sound was given similar to the Least Flycatcher's but in a different tone or at least it was a poor imitation. Several times on subsequent days I heard the Catbird practicing this note as it were. Once the Least Flycatcher was singing at the same time and the Catbird would give its imitation, then stop as if (this was the appearance) to listen again. It finally became so good that its imitation was close enough to have passed easily for the Chebec's own note. In other words with the pattern before it so to speak, it had perfected its imitation until it was an almost exact reproduction of the Least Flycatcher's note. It seemed a clear case of mimicking."

An interesting instance of mimicry in the Catbird is reported

by Marie Ellis Hegler ('Bird Lore,' XXV, 1923, p. 252) who, every time she saw a particular Catbird in her garden, greeted it with a short whistling call hoping that it would imitate her. This imitation did not occur that summer, but the next spring she was startled by hearing her own familiar whistling call and discovered the Catbird to be the source.

Mr. Francis H. Allen, a keen observer, especially in the matter of bird notes, has also heard the Catbird mimic the Chebec as well as the following birds: Crested Flycatcher, Wood Pewee, Cowbird—the flight call—Chewink, Scarlet Tanager—the *chip-chur* call—Yellow-throated and Red-eyed Vireos, Black-poll Warbler, Brown Thrasher, Wood Thrush and Robin.

Another mimic, which like the Mockingbird belongs in the Austro-riparian zone, but sometimes is found in the Transition zone, is the Yellow-breasted Chat. For six years, from 1908 to 1913, I had the opportunity to study one or possibly two pairs of these birds at Ipswich. They inhabited a tangle where Brown Thrashers, Catbirds and Red-winged Blackbirds were common. The varied calls of these birds were mimicked more frequently than those of any other birds, and the mimicry was so perfect that I could never be sure that a Chat was responsible unless I saw him lift his head and open his bill when the sounds were produced. He smacked like a Thrasher, mewed like a Catbird and chucked like a Red-wing. The clear melodious notes of the Robin and Baltimore Oriole were reproduced as unmistakably as were their alarm notes. The *jay jay* of the Blue Jay and the squirrel-like rattle of the Maryland Yellow-throat, as well as the varied *caws* of the Crow were all given in perfection. The clucking of a domestic hen and the barking of a small dog made me look about for the originals, until I found that the Chat was the producer of these sounds. Doubtless many more imitations by the Chat are to be heard in its southern home, but these will suffice to show the bird's powers of mimicry.

As far as I know, the only mimicry in which the Blue Jay habitually indulges, is the cry of the Red-shouldered Hawk. The imitation is so perfect that, on hearing this cry, if one does not see the bird, one should wait and in a short time the *jay jay* cry will reveal the mimic, if such it be. On one occasion I heard the Red-should-

ered Hawk's cry frequently and loudly repeated, and saw two of these birds circling about, but in a different direction from the source of the sound. Presently the cry changed to *jay jay*, and I discovered some Blue Jays near at hand. The circumstances suggested that they had espied the Hawks and were mimicking them. Mr. Francis H. Allen tells me he has heard the Blue Jay mimic the *kip kip* call of this Hawk as well as the call of the Broad-winged Hawk. Aside from repetitions of sweet notes that strongly suggest the song of the Brown Thrasher, and notes that suggest those of a Carolina Wren, I have heard no other imitations by this bird.

Audubon expresses the opinion that the discordant cries of the Shrike are imitations of birds in distress, and that they serve to beguile small birds within his reach. This fanciful and improbable theory comes down from the Middle Ages, for one Dame Juliana Berners denounced for the same reason the European Grey Shrike and stigmatized it as "an ungrateful subtell fowle." The disconnected song of the Northern Shrike, with its mixture of harsh and sweet notes, suggests that of the Catbird. Sometimes the clear notes resemble those of Robins, sometimes those of Blue Jays and again of Red-eyed Vireos. With the latter birds Shrikes were formerly classed.

The Solitary Vireo is a bird that appears to take pleasure in improvising and in repeating certain phrases. I once heard one in Gaspesia that repeated the phrase *tu-a whee* five or six times very sweetly and then paused while another Solitary Vireo mimicked it perfectly. Then number one tried another phrase, and this also was imitated, but, after a couple of more lessons, number two evidently tired of the game and remained silent. It is probable that in this way an inventive bird may add to and improve the songs of those of his neighbors who are bright enough to imitate him.

A parallel instance is furnished me by Mr. F. A. Saunders, who tells me that, by changing the pitch of his whistling imitation of a Chickadee's song, he has induced the Chickadee to change his pitch also.

Another bird of the Upper Austral zone, the White-eyed Vireo, which extends its breeding range north of Boston, should be classed,

it seems to me even on slight acquaintance, as a mimic, and a very Chat-like one. I have heard him call like a Bob-white and a Whip-poor-will. Burroughs speaks of his notes suggesting those of the Robin, Wren, Catbird, Flicker, Goldfinch and Song Sparrow, and W. L. McAtee says he has heard this Vireo imitate closely the notes of the Wood Pewee.

The similarity in some of the notes of the Golden-crowned Kinglet, Brown Creeper and Chickadee, birds that associate closely in similar environment, is significant.

Some years ago in Ipswich, on three occasions in the month of June, I heard and saw a Song Sparrow sing the clear, sweet whistling trill of the Field Sparrow with a Song Sparrow ending. Occasionally he would sing an ordinary Song Sparrow song. The bird was always in one particular tree.

The family of Warblers is noted for the variability of its songs. Many, besides having two distinct songs, sing at times in a way that suggests other members of the group. The close association of different species of Warblers in the same habitat gives opportunity for imitations. I have heard a Chestnut-sided Warbler trill like the Pine Warbler, and another, whose notes were loud and clear and frequently repeated, recalled in a surprising way the song of the Oven-bird. The song of the Nashville Warbler is characteristic and easily recognized, but I have been astonished on two occasions to detect a Myrtle Warbler singing this song.

At Isle Haute, Nova Scotia, where, in a bit of woods, Tennessee Warblers were in full song, a Black-throated Green Warbler sang so exactly like his Tennessee neighbors that I would have been deceived had I not seen the singer at close range and detected him in the act. Later I heard and saw the same bird sing his own distinctive song.

Mr. F. H. Allen has several times heard the Prairie Warbler begin its song with an excellent reproduction of the song of the Field Sparrow that was singing nearby. He has heard a Red-eyed Vireo introduce the call of the Bluebird in his song, the Scarlet Tanager imitate the notes of the Olive-sided Flycatcher so perfectly as to deceive him at first, and the Purple Finch add notes from the song of the Barn Swallow.

Witchell¹ suggests that, as nestlings reared by hand have so often been observed to imitate the song and notes of other species in the same cage or even the various sounds heard around the cage, wild nestlings in the same way have had their future songs influenced by the sounds familiar to them in their environment. "It may be justly surmised," he says, "that nearly the whole range of bird-song may have been affected by the imitative faculty, which we know to have been so wide-spread an influence in the animal world; and that the voice of the bird has been attuned to harmony with neighboring sounds, just as its colours so often blend with those of its surroundings."

The song of the Water-Thrush has a bubbling, watery character as has also that of the Canadian Warbler and Winter Wren,—all birds that often build their nests within hearing of rippling brooks. The song of the Sharp-tailed Sparrow resembles the hissing of the tide through the grass besides which its nest is built. The Grasshopper Sparrow, as its name implies, and the Savannah Sparrow have songs which resemble the grasshoppers that abound in the fields where the young are raised. Wilson says that the song of the Long-billed Marsh Wren is "something similar to that produced by air-bubbles forcing their way through mud or boggy ground."

In the evolution of bird-song, mimicry as well as invention have through sexual selection played a part. It is obvious that a natural selection would have a limiting effect on mimicry. Thus, the Song Sparrow that always sang like a Field Sparrow, would run little chance of getting a mate. The conservatism and clannishness of birds would preclude wide variations in song.

By the term invention or improvisation, I do not mean that a bird produces an entirely new and complete song, but that he adds short phrases or slight variations under the impulse of rivalry, or from the mere aesthetic pleasure of the performance. If these new phrases are copied from the songs of other birds, it is a case of mimicry, but if not, the case should be classed under improvisation. It is sometimes difficult to separate these, as in the case of human music, but familiarity and close attention has long convinced me

¹ *Op. cit.*, p. 229.

that both of these methods are present in the evolution of bird-song.

In the case of some birds like the Mockingbird, the Starling and the Chat, mimicry has become an integral part of the vocal courtship. Birds like the Catbird and Shrike are obviously making use of mimicry in the improvisation of their songs. Mimicry is less evident, but is occasionally to be detected, in the songs of the Brown Thrasher and Solitary Vireo, as well as in the notes or songs of many other birds, especially in the group of Warblers.

Our greatest avian musician, the Hermit Thrush, is an improviser or inventor of the first rank, and, although some of his notes may have had their inspiration in the songs of other birds, he appears to be entirely original. The Hermit's near relative, the Olive-backed Thrush, on the other hand, shows but little variation in his song. He appears to be neither an improviser nor a mimic.

Witchell¹ mentions over a score of British birds where he has observed mimicry, and, from my own studies, I am convinced that mimicry among our American birds is more common than is generally supposed. It follows, therefore, as a minor corollary that, while sight records are worthless unless the observer is known to be accurate, records by hearing alone, even if the recorder is an expert, may be worthless, owing to this prevalence of mimicry. Above all, one should beware of the mimicry of that specialist, the European Starling.

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NOTES ON THE BIRDS OF WALLOWA COUNTY, OREGON.

BY IRA N. GABRIELSON.

DURING the past four years field supervision in the rodent control work of the Biological Survey has taken me at various times into Wallowa County, which is the northeastern county of Oregon. This county has now been visited at practically every season of the year and notes have been taken on the birds seen

¹ *Op. cit.*, pp. 159-229.