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THE STUDY OF BIRD SOUNDS

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IN A RECENT number of the CONDOR Mr. Richard Hunt[1] proposes a new method of studying bird sounds. Having made a study of bird sounds and songs for a number of years, and having once myself proposed a method of studying and recording them,[2] I am much interested in Mr. Hunt's proposal. I hope that what I have to say now will aid in unifying and clarifying our ideas on the subject and that what criticism I have to offer will be considered constructive.

Mr. Hunt's chief contention is that bird sounds are "human speech-like." When I first read his article I did not fully comprehend just what he meant by this, but thinking it over, trying it out in the field on actual bird sounds, I believe I now do, and am in a position to discuss and criticize. If bird sounds are more like human speech than human singing, then it is pertinent to inquire what is the difference between human speech and human singing. In singing, the important things are time and pitch. In speech the important factor is pronunciation. A person may sing a tune with different sets of words at different times, or with no words at all, and the music remains the same. A person may say the same thing over in high or low pitched voice, rapidly or slowly, but what he says remains the same. Pitch and time may help or hinder the expression of a speaker, and make what he has to say more or less impressive upon his hearers; but his words reduced to cold print are the same, no matter what time or pitch changes he may have used. Mr. Hunt's contention, therefore, means essentially that in bird sounds, pronunciation is more important than either pitch or time.

I regret my inability to use, as examples of what I wish to say, species whose notes and songs are likely to be familiar to California ornithologists as well as to myself, but even when the same species ranges in both states, it is likely that geographical variation will make the songs quite different. Listening carefully to various Connecticut species in the field, I find some in which the pronunciation factor stands out as an important and characteristic factor. The White-eyed Vireo is perhaps one of the best examples, and with it, the Water Thrush, the Canada and Wilson warblers, and, though not a common Connecticut species, the Cardinal. In

[1] The Phonetics of Bird Sound, by Richard Hunt; Condor, xxv, pp. 202-208.

[2] Suggestions for Better Methods of Studying and Recording Bird Songs, by Aretas A. Saunders; Auk, XXXII, pp. 173-183.

most other species the pronunciation factor is also present to a greater or less degree. The sounds may be distinguished and classified, as Mr. Hunt suggests, as musicals, explosives, fricatives, etc. (It seems to me, here, that the proper term for the *l* and *r* sounds, that Mr. Hunt calls "musicals," is "liquids.")

But even in the species I have named in which pronunciation stands out as a character of first importance, time and pitch are also easily distinguished and play an important part in the character of the bird's song. A White-eyed Vireo calls, and I write *Chick-weeah—chickeroo-chick.* Then I note without difficulty that the pitch of the first "chick" is two and a half tones below the "wee", that the "weeah" slurs downward three and a half tones. Similarly, I note that the "chick-weeah" occupies the same period of time as the "chickeroo-chick", and that the longest time and loudest accent is on the "wee." A graphic record of this song, with the phonetic rendering written beneath, will show all the points; but the phonetic rendering only, would show them only approximately. Determining the pitch and time of this song is as simple and easy as determining the phonetics, and much easier than to determine the pitch in the voice of a human speaker.

In such species as the White-throated and Field sparrows, I find it difficult to distinguish the pronunciation factor at all. The notes are pure, clear musical tones. Time and pitch are important characters. In the songs of such species, and of others such as the thrushes, Mr. Hunt's statement that bird sounds are more like human speech than human singing does not seem to me to apply in the least particular. In the voices of shore birds the musical factors are strong and the pitches clear and distinct. I have found no difficulty in determining pitches in the calls of gulls, the screams of hawks, and the various call and alarm notes of many species, that are not songs and are therefore not necessarily musical. There may be bird sounds wherein pitch is as difficult to determine as it is in the speech of a human being; but if so they are exceptions. To sum it up, bird sounds are simply sounds, sometimes like music, sometimes like speech, but to be studied scientifically from the standpoint of the physics of sound.

It is important that students of bird sound should agree as far as possible as to the factors to be described. Mr. Hunt names seven factors: pitch, intensity, rate of speed, form, expression, timbre, and phonetic quality. I named five: pitch, duration, intensity, quality, and pronunciation. We are perfectly agreed on "pitch" and "intensity." Mr. Hunt evidently means by "timbre" what I mean by "quality," and by "phonetic quality" what I mean by "pronunciation," so that we agree there, except in the names we use. I am willing to use Mr. Hunt's phrases, if the majority of students of bird sound favor them in preference to the ones I have been using. "Quality" is the term most commonly used by the physicist, while "timbre" is used by the musician. The physicist is more scientific than the musician, but possibly "timbre" is a better word, for "quality" has other meanings. If we use "quality" and "phonetic quality," there is chance for confusion. "Phonetic quality" is a little long for a term, and I think not so good as "pronunciation"; but possibly simply "phonetics" is better than either.

Since my first writing on this subject I have changed my word "duration" for the shorter, simpler word "time." I meant the same in either case, but "time" is more inclusive, and includes Mr. Hunt's "rate of speed", though I fail to see why the simple word "speed" does not mean the same thing as "rate of speed", or if we must have a longer, more scientific sounding word, call it "velocity." Time, however, is the main factor, including velocity, acceleration, retard, rhythm, rests, duration,

and perhaps other things that someone may want to include as new factors. There are, then, in my estimation five factors of bird sound: pitch, time, intensity, quality or timbre, and pronunciation or phonetics.

It is often possible for two or more of these factors combined in a single note or phrase to produce peculiar sound effects that are often the specific characters of the songs of certain species. These combination effects are, in my estimation, what Mr. Hunt would class as "form" and "expression." He gives "staccato" as an example of "form." A staccato note is a note short in duration, of even rather loud intensity, followed by a sudden abrupt pause. Therefore I should say that staccato is a combination of time and intensity.

It seems to me that expression is also a factor that is produced by a combination of one or more of the other factors. The composer writes human music, and puts in expression by marks indicating changes in time or intensity. Quality may also have much to do with expression. Pitch and intervals of pitch between different notes also influence expression, for the composer writes bright, lively music in major keys and sad or dolorous music in minor, and the difference between major and minor, when there are no chords, as in bird music, is merely a matter of pitch intervals. I believe that the expression in bird sounds may be reduced to terms of pitch, time, intensity and quality, and that in itself it is not a separate factor. I am therefore still unconvinced that there are more than five factors to consider in the description of a bird sound.

Mr. Hunt states that his method, based on phonetics, provides for the recognition of all the factors of bird sound. He shows how it indicates relative pitch by the vowel sounds used. This is good as far as it goes, but why not measure pitch as accurately as we can? In my experience pitch of most bird sounds can easily be determined in the field, and I believe that anyone with a good enough musical ear to whistle a few bars of a tune and keep on the key can learn to do it by a little practise. There are many interesting and important things to be learned about bird song by determining accurate, rather than merely relative, pitch.

It is not quite clear to me how Mr. Hunt intends to record time, intensity and quality by phonetics. But, however it be, mere relative representation of these factors will not be satisfactory if they can be determined with greater accuracy by other means.

On the question of phonetics or pronunciation, Mr. Hunt has given an admirable classification of consonant sounds produced by birds, that ought to be helpful to all students in studying this factor in the field. In my first discussion of this factor I treated only the liquid consonant sounds, since these are among the commonest and in the more musical bird songs are often the only ones present. I devised a method of representing such a liquid consonant sound in a graphic representation of the song. Since then I have recorded many songs with consonants in them other than liquids, and have found no practical method of representing such sounds in the graph of the song. I have, however, represented them by writing beneath the graph a phonetic record similar to that which Mr. Hunt suggests. Such a record was published in discussion of a peculiar double song of the Cardinal (Auk, XLVIII, pp. 539-541). I believe that such a record gives as complete a representation of a bird sound as it is possible at present to make, with the single exception of the quality factor. If we write above the record a word or phrase descriptive of the quality, then we have the five factors complete. We sadly need a classification of sound

qualities that will make what we can learn of this factor more definite and uniform; for quality remains the one factor of bird song that is most difficult to describe and is least tangible.

The question of phonetics, however, may not be so simple as it seems. It is easy to distinguish liquid, explosive or fricative consonant sounds from each other, but it is not so easy always to distinguish between *l* and *r*, or between *p*, *k* and *t*. I believe, also, that birds produce consonant sounds that are often not to be represented by any letter or combination of letters in human alphabets. The best we can do in such cases is to come as near as we can to a phonetic representation of the sound.

The graphic method of recording bird sounds, which I proposed a number of years ago, may be regarded by some as a failure, since, so far as I am aware, no other student of the subject than myself has attempted to use it. To me, however, it seems no failure, for I have at the present time a collection of about three thousand bird sound records, including songs and calls of 128 species. The study of these records is of absorbing interest and brings out many interesting and important facts, only a few of which I have had time to write up for publication.

The chief reason why this graphic method has not been adopted by others is, I believe, because it calls for a more exact rendering of pitch and time factors in the field than other methods, and other observers have either been unable, or believed themselves unable, to do it. I found the work difficult and slow at first, but practise has made it comparatively easy. Some bird songs may be recorded as perfectly by musical notation as by the graphic method, in fact more than I supposed when I first started the study. But the graphic is much simpler, easier, and quicker to use in the field, and therefore more efficient.

For those who cannot determine exact pitch or time I might add that it is perfectly possible to use the principle of the graphic method, making records on plain paper without either horizontal or vertical lines, and get a good representation of the main characters of a bird song. I have used it in this way in teaching, and found that simple graphs on a blackboard are useful in teaching students the distinguishing characters of a given bird song. A somewhat similar method to this has been used (Wheeler and Nichols, Auk, XLI, pp. 444-451) in describing songs of the Song Sparrow, and though exact pitches were not noted, much of interest on the song of this bird was brought out clearly. Records of bird songs in which pitch and time are only approximate bear the same relation to accurate records that descriptions of birds in popular handbooks do to descriptions in scientific manuals. The inexact description serves admirably to teach others the main character of the song, and may therefore serve to make a greater number of efficient field students. But when one wishes to make a detailed study of the song, to work out problems of individual, geographical or seasonal variation, to recognize individual birds by song, to throw light on the problem of heredity versus imitation, the records should be as exact as it is possible to make them.

The study of bird sounds ought to be just as scientific a part of ornithology as is the study of plumages. Looking over ornithological literature for descriptions of bird sounds, one is impressed with the fact that it has not been so regarded in the past. It may be more difficult to describe a bird's voice than to describe its plumage, but that is no reason why we should not do it as accurately as we can. Many descriptions we have are merely fanciful, almost poetical, and probably not meant to be otherwise. Students using musical notation have disregarded other factors than pitch and time. Students using phonetic renderings have disregarded all save phonetics and perhaps relative pitch.

To describe all factors of a bird sound in the field requires some training and practise, just as the description of subspecies requires training in color and methods of measurement. One with a reasonably good musical ear may train himself to recognize pitches, to recognize instantly the difference between a tone and a half-tone, a third and a fifth. Dealing with such high pitched voices as most birds have, however, he cannot do it without practise. The sounds and voices of many of our commonest birds have never been adequately described. There is a big field here for active ornithological work. Nearly all observers probably know many facts about bird sounds that have never been put into print.

Roosevelt Wild Life Forest Experiment Station, Syracuse, New York, August 16, 1924.

SOME NEW RECORDS FOR NORTHEASTERN CALIFORNIA

By JOSEPH MAILLIARD

(Contribution from the California Academy of Sciences)

SO FAR as the study of geographical distribution of bird life was concerned, the results of our field work in northeastern California in the spring of 1923 were rather disappointing, as but little of interest in this regard was discovered. Observations carried on in Modoc County from May 8 to June 14, however, were indicative of more promising results, provided that a good locality from an observer's standpoint could be found, and it was decided to make this County the scene of spring operations in 1924.

In the case of birds, the most interesting distributional record we made in 1923 was the confirmation of the presence of the Ferruginous Rough-leg (*Archibuteo ferrugineus*) in Modoc County. The only previous mention of the occurrence of this species in northeastern California is that made by Mr. H. W. Henshaw in the Report of the Chief of Engineers for 1879, Part III, p. 2293, where, under the head of *A. ferrugineus* (Licht.), he says, "A hawk was seen in Northeastern California which I believed to be of this species."

On May 10, 1923, while we were encamped at the Deep Creek Forest Service Station in a cañon on the east side of the Warner Mountains, my assistant, Robert J. Woods, went up to the top of the range. On his return to camp, he reported having seen several large hawks which acted as if they were nesting in the vicinity. Two of these, he said, were different from the others, and from his description, it seemed as though they must be the Ferruginous Rough-leg. After the differences between this species and other hawks that he might find there were explained to him, he was sent back, on May 15, with orders to bring in a specimen of the Ferruginous Rough-leg if possible. But the nest of the pair of hawks, apparently of this species, was on a high cliff (inaccessible to one unaided), and a strong gale was blowing that day. Woods got a shot at one of the birds but failed to secure it; he returned, however, convinced that he was right in his identification of it as *Archibuteo ferrugineus*.

On June 11, this species was also noted at Jess Valley (Modoc County), where, at the west end of the valley in the Pit River cañon, a pair of the birds had a nest. This nest was in plain view in a pine tree on a hillside on the south side of the river. There was too much water in the river to allow us to cross it except at a long distance above the nest, but the birds came near enough to us to be easily identified, and this