NATURE'S "UNIVERSAL VOICE": A COMPREHENSIVE SURVEY OF BIRD SONG

by

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As E. M. Nicholson has said, bird song is "The universal voice of nature." Not only does it have a greater range of qualities than the rest of our planet's animal sounds put together, it is also more pervasive in time and space. In cold places and times insects, frogs, and toads are silent, but a Northern Cardinal (*Cardinalis cardinalis*) has been heard to sing at -20° F (-9° C) and a Pine Grosbeak (*Pinicola enucleator*) at -50° F (-44° C). At the other extreme, Black-throated Sparrows (*Amphispiza bilineata*) may sing in the desert of California at "temperatures so high as almost to be unbearable to humans" (Miller and Stebbins 1964, p. 255).* Where there are insects there are usually also birds, but the latter, being warm-blooded and non-hibernating, are active all year, and entirely songless months scarcely occur.

Contrary to some careless remarks about the tropics, birds sing nicely everywhere, save where land birds cannot live, setting aside those elevated "lonely lands" close to the sun where the scream of an eagle may be the only avian sound. There is no region that nature forgot in this regard, unless it is the frozen poles - yet the Snow Bunting (*Plectrophenax nivalis*) sings within 8 degrees of the North Pole - or bare sea rocks, or the most utterly barren hearts of deserts. Wherever there is enough warmth and moisture for even the sparsest vegetation over any considerable area, there birds of songbird type occur, and most of these are singers in some degree at least. If you were to land anywhere from a helicopter, or parachute, unless the spot were extreme desert, mere ice and snow, a barren sea rock, very high mountain, or the most stony, concrete, or asphalt heart of some city, you would be in a spot at which, during part of the year at any rate, and part of the day, singing birds would be in evidence.

Compared to the sounds made by insects and amphibians, bird song has one marked limitation: it is largely confined to the daytime. No truly nocturnal birds are found among songbirds (oscines), or even, with a very

* The reader may want to refer to the "Note on Scientific Names and Literature" at the end of this essay.

few exceptions, among the organically more primitive birds which sing at all well. The truly nocturnal birds - nightjars (whip-poor-wills and their kin) and owls - can be said to sing, but their musical efforts are generally also primitive. The Common Nightingale (*Luscinia megarhynchos*), the Northern Mockingbird (*Mimus polyglottos*), and some other oscine species (a few in every major region) may sing for many minutes in the night, but these species sing as much or far more by day, and of course their feeding is essentially diurnal. On the other hand, the dawn chorus begins almost at the first suspicion of light, and the evening singing often extends into the night. An individual of perhaps any songbird species may occasionally awake in the night and sing briefly.

In many, probably all, regions, singing does not cease entirely even in the middle of hot days, at least at the height of the song season. Yet the most intense singing, nearly everywhere, is near dawn; also, the entire first half of the morning is likely to be much better than the afternoon, except sometimes for an hour or so around sunset. Some North American thrushes perhaps slightly favor evening singing.

In subtropical mountainous Queensland, Australia, I noticed that the evening utterances were mostly harsh and that the more musical species concentrated their efforts in the early morning, when the more raucous species were relatively quiet.

Jared Verner (1965) has an ingenious, indeed brilliant, theory to explain the great burst of singing at dawn. In order to maintain until morning their body temperatures, which are then usually higher (even in the tropics) than is that of the air around them, birds must end each day with a surplus of energy. Safety requires that this surplus be more than enough to last through a normally cool night, since otherwise one abnormally cool could have damaging consequences. Hence the bird will usually waken without immediate need to feed. Also the light will be inadequate for efficient foraging! Yet the animal is refreshed by sleep, ready to act vigorously. And so, the best or most natural use for this part of the day, except after unusually chilly nights, will be to proclaim territory or address a mate by singing energetically.

A similar theory can explain why some species sing on mild winter days. They have a margin of nourishment by which they may survive excessively severe days, and when this surplus is not needed to survive, it may overflow in song. To say that the bird "sings for joy" on such occasions may not be as foolish as some suppose. For an awake animal in

abundant health likes to *do* something. If feeding, courting, nest building, caring for nestlings, etc. are not at the moment in order, singing may be the something. Some birds seem at times to fly for the fun of it, others may sing for the fun of it. Activities may be enjoyable in themselves, even if they have no useful results. Natural selection takes no direct account, it is true, of how birds feel but only of how they act. However, what birds must (for survival) do a great deal and for long periods, as many of them must do singing, can hardly be something they feel negative or indifferent about.

There is an interesting division of time between singing birds and other singing animals. The climax of bird song in much of the North Temperate Zone is from mid-March to mid-May, that of insect song in July, August, and early September. Also, some insects (and most amphibians) are nocturnal, and the rest sing most vigorously in the middle of the day; whereas birds prefer the early morning and late afternoon, just the times when insects are quietest. As Keats sagaciously put it, "the poetry of earth is never dead." In the Philippines it was very noticeable to me how almost completely birds and insects avoided competing with each other in sound production. At dawn many birds sang, and scarcely an insect was to be heard; by about nine o'clock, the cicadas were screaming so fiercely that birdsong would have been largely futile. The birds seemed to sense this; for I could detect few songs in the forest at this time.

Keats's fine observation applies least well to bitter wintry weather in high latitudes or high elevations. In the cold winter daytime a few birds may perhaps be heard, but no insects or amphibians. And in freezing nights, the rhythmical hooting of owls or howling of wolves (which is song) may be the most one can expect - and even they only where our species has not crowded or persecuted these splendid creatures out of existence. Only in the tropics does nature almost always have musical as well as unmusical voices. (It should scarcely need saying that any animal's voice is better than none - any animal's, that is, except occasionally ours, when one has, for a time, had enough of our rash and overbearing pronouncements.)

There are also time-divisions between different species, or groups of species, of singing birds. Not all the species of songsters begin their dawn singing at the same moment (in shady forest it may be later) and not all persist in them until the same moment of twilight. Each species has its characteristic behavior in these regards. The dawn-listener enjoys

successive waves of sound, in which first one species or group of species predominates and then another. After the first burst of singing, individuals may begin to feed, and may therefore cease to sing altogether for a time, though some species sing while they feed.

In general, birds seem to avoid the sort of competition with other sounds which would result in mere confusion, and nullify the effects of their singing. They tend to cease during strong winds and hard rains, the simplest explanation being that they sense the ineffectiveness of their voices against the sighing, rustling, or pattering which fills the air. For one thing, they must miss singing by territorial rivals, whether disturbingly close or satisfactorily distant. Surely some of the stimulus to sing comes from hearing rivals. One who keeps canaries knows (and I recall an acquaintance demonstrating this to me) that two at the right distance from each other (preferably out of sight), easily audible but not deafeningly close, will do more singing than a single canary, or two otherwise situated in relation to each other.

Most songs, especially those of good quality, come from species belonging to that large subgroup of perching birds (about 45% of all species) called oscines or "true songbirds." These species are anatomically specialized for acoustical skill; they have four pairs of muscles instead of three or fewer, for controlling the syrinx, the organ by which sounds are produced - apart from noises that birds of some species make by snapping their bills or flapping their wings. Songbirds, nearly 4,000 species, form the majority of land birds. Though they are all anatomically (except perhaps in their brains) well equipped to sing, only something like 3,200 species (to make a rough guess) do so to any very noticeable extent. Thus, in this one group, we have the entire gamut of avian musical development, from almost zero to the most birds are capable of. The reason is in the enormous variability of ecological adjustments, from the extreme of territoriality to the extreme of gregariousness, from feeding largely upon fruit, nectar, or seeds to feeding almost entirely upon insects, worms, or higher-level animals, from living in the densest forest shade to living in the blaze of the desert sun. Many species are largely visual creatures; many are among the most intensely acoustical of all animals. We need scarcely go outside the group to encounter most of the evidence required to understand birds as musicians. We shall have them primarily in mind throughout. However, I have heard songs from hundreds of suboscine perching birds and acoustically still more primitive types and have tried to

take them into account where they furnish important evidence.

Most singing, and especially the best singing, is by males. Still, many hundreds of females sing habitually (in tropical areas chiefly, and among non-migrants). A female of any singing oscine species may sing at least a little, to judge from numerous instances. But in tropical and subtropical regions a large minority of species maintain pair contact the year round by male-female duetting. In some the female sings beautifully. The female European Robin (*Erithacus rubecula*) sings to some extent in autumn and winter to establish her own feeding territory, and the Northern Mockingbird has this habit. But in low-level tropical lands, where neither the difficulties of migration nor those of winter cold have to be faced, many pairs continue to cooperate musically outside the breeding season. The resulting duets between male and female take many forms, and are often highly musical, as in the Tropical Boubou (a shrike, *Laniarius aethiopicus*), or the Grey Shrikethrush (*Colluricincla harmonica*) of Australia. I incline to view this duet phenomenon as, in a way, the finest thing of all in the music of nature. It is scarcely found in Europe and the United States, but common enough in all regions "where winter never comes," to use Marston Bates's apt phrase.

Many species sing much of the year. The (non-migratory) Carolina Wren (*Thryothorus ludovicianus*) sings all year, although most of its singing occurs in the breeding season. In regions with mild or no winters there is singing by some species at almost every season. Of course breeding is also somewhat irregularly distributed throughout the year in these areas, but singing does not, even nearly always, closely coincide with it. The functions of song are too various for that. It may proclaim a non-breeding foraging territory, it may keep pairs united until the next breeding season, or perhaps sometimes it just takes up surplus energy now and then. The bird may like to sing; if it has energy to spare, and its safety will not be jeopardized, why should it not do so? Evolution cannot, at least in the short run, select against an activity if it is not harmful. Or, there may be survival power in an outlet for surplus energy which can always be desisted from when emergencies arise requiring all the bird's strength and waking effort to cope with.

There exists a notion that one must have heard a song in childhood to appreciate it highly. This is a statement about only some listeners. It scarcely applies to this writer, as I confirmed when at the age of 55 I first went to the South Pacific, Australia, and New Zealand. I now do not know

which songs I prefer, those of eastern North America where all my childhood and early youth was spent, or those of many far-away places.

Another notion is that in thinking about a song one cannot abstract from the charm of the bird's habitat. Again, one should speak for oneself. Some have analytical minds, and can make the abstraction in question; perhaps some cannot. I appreciated to the full the marvelous music of the Rufous-and-white Wren (*Thryophilus rufalbus*) from a recording long before I heard it in its habitat. So with many another song. There are people who cannot appreciate certain foods because of some unfortunate association. I have no such reactions. Some people cannot sense the vital beauty, the unity in its diverse functions, of a lithe green tree snake, or other snake as it slithers up a tree, simply because of their associations with that term "snake." It is possible, however, to distinguish between what one tastes, sees, or hears and what is present in some irrelevant part of one's experience. The snake's parts and functions *visibly* fit together and give it a measure of beauty; those who cannot see this are, insofar, blind. And so do the contrasting aspects of a song fit together.

Writers who stress how personal or subjective judgments of this kind must be are perhaps unwittingly confessing a personal weakness, an inability to observe relatively impersonally. The wren spoken of above has a musical theme, it runs through a considerable repertoire of variations on the theme, and for its size it has remarkably low pitches. Its tone quality is fairly musical (i.e., there is sharp frequency control). These are biological facts, nothing peculiarly to do with me or any other human being, and they are facts about this wren. They would be false if said about most other singing birds. An evolutionary process must have been required to take this species from some primitive mode of singing to this rather complicated and refined mode. Those who think this is just a bird singing in an odd way are, in a sense, deaf. An otherwise excellent ornithologist I know was puzzled because I admired this wren's song, since, he said, "it sounds like an owl." (Other observers have admired it; it is his reaction that was eccentric.) Some writer (I forget which) had said that the bird's voice was "like an owl's." Presto, association with owls, not very musical birds! But the unusually low pitch, an achievement for so small a bird, something about the timbre, and perhaps some slight similarity to the pattern of a few owl calls, is all that the comparison really registers. And it tells nothing about the variations, the great pitch range for the bird's size, etc. This was not a mere difference of human feeling, it was a difference in the quantity of observed bird facts. The other man was not carefully observing. He

was crudely reacting or associating and thought I must or should be doing the same. I was analyzing the acoustical facts, or trying to.

Ornithologists of course differ in their ability to study and describe song, as they do in other capacities. Frank M. Chapman, William Beebe, and Ludlow Griscom, without being specialists in this study, made extremely discriminating and informative observations. Some writers either avoid the subject, or put the reader off by calling the sound indescribable, or (I have been guilty of this) use terms such as *trill* without specifying whether the word is used in the strict musical sense, or *warble*, which covers a very wide range of musical forms. Like Aretas Saunders but unlike Griscom, I have some doubts about the descriptive value of the term "ventriloquial." How much trouble one has to locate a singer probably depends upon various factors. (Certain alarm notes seem hard to locate, and some birds sing now softly, now loudly, and this may make the locus appear to change.)

People ask me, What song do you think is the world's best? It used to be a truism that the Common Nightingale was just that. Yet there are in Europe two closely related species of nightingales (*L. megarhynchos* and *L. luscinia*), and some prefer one, some the other. Also some (including this writer, as well as Peter Szoke of Hungary, an expert on bird song as music, and pioneering bird-sound recordist Ludwig Koch) prefer the Woodlark (*Lullula arborea*), others the Common Blackbird (*Turdus merula*). If there is this much disagreement without going outside Europe, where only 0.4% of the world's songbirds occur, what hope can there be of agreeing on a world-wide comparison? Even if we had all heard all species, would there be much sense in picking out just one as *the* best? Who is the best of all musical composers? Mozart? A good answer, but is it the only defensible answer? And which composition of Mozart's is the best? Isn't this a rather silly question? They are pretty much all good. Does it follow that there is nothing objective about the idea of "good" as contrasted to "poor" musical composers? Hardly. Many of us can make poor or mediocre musical compositions. I sometimes do something like it, in whistling to myself. The difference between poor and good has some factual meaning, but the precise best - that is no factual matter. Here an analogy is helpful. Anyone catching sight of Mt. Everest in Nepal (as I have done), will know that he sees a high mountain. But that it is the highest in the world, or even in Nepal, only the most accurate of measuring devices could possibly tell us. And is it important? To climb a mountain a few percent lower is not necessarily a lesser feat, and might be

harder. The cold, and oxygen deficiency, will be similar. In judging musical skill we must be content with still broader contrasts than in measuring mountains by the naked eye. There are very low hills, low hills, high hills, moderately high mountains, very high mountains, extremely high mountains - so much intuitive judgments will perhaps give us. Similarly, there are very low degrees, low degrees, middling degrees, rather high degrees, very high degrees, of musical skill, but no highest degree, at least none with but one instance.

The pitch of a singing bird's voice may be more than an octave above the highest piano note, but it may be not far from middle C (Tui; *Prosthemadera novaeseelandiae*, of New Zealand) or still lower, as in the tinamous (family Tinamidae; chicken-like ground-dwelling birds of the American tropics). For the most part, bird music is somewhat higher in pitch than human music. To this extent (and in some other ways) it supplements rather than rivals our productions. This is especially true of the smaller songsters; for, in general, the smaller the bird the higher the pitch. Small birds are physically unable to produce musical tones of low or even medium pitch. This is sometimes an aid to identification. In New Zealand the Tui and the Bellbird (*Anthornis melanura*) are (or so it seems to me) sometimes confused, being often found together. But the Tui, being much larger, reaches deep mellow tones which, I believe, the other bird cannot attain.

It is well known that singers tend to be small. Wrens, warblers, canaries, and many others illustrate this thesis. However, the Australian lyrebirds (*Menura*, family Menuridae), now considered songbirds, are among the largest, and have a far greater pitch range than any much smaller bird, and meet some other requirements of highly developed singing; also bellmagpies (family Artamidae), with an unusually high proportion - 6 out of 12 species - of famous singers, are among the largest of perching birds. Mockingbirds and thrashers (family Mimidae), with perhaps the next-highest proportion, are middle-sized or a little more, as are perhaps a third of the thrush family (Turdidae). Drongos (family Dicruridae) and New Zealand wattlebirds (family Callaeidae) are rather large; shrikes (family Laniidae) and leafbirds (family Chloropseidae), the best of the honeyeaters (family Meliphagidae), two of the best larks (family Alaudidae), some musical New World orioles and their kin (family Icteridae), bulbuls (family Pycnonotidae), babbling thrushes (family Timaliidae), whistlers (*Pachycephala*, family Pachycephalidae),

and finches, e.g., Northern Cardinal, are middle-sized. Thus the correlation of song with smallness, though perhaps real, is not very strong.

Smallness favors song in that it makes for visual inconspicuousness, and hence magnifies the need for auditory communication, and also in that the smaller the bird, the larger the number of individuals and species with similar-sized vocalizing apparatus, hence with similar pitch levels, there can be in a small area. Therefore, the danger of confusion, apart from distinctive patterns of vocalization, is greater with the smaller birds. But the lack or scarcity of superior songs among swallows, titmice, nuthatches, creepers, weaver finches, vireos, wood warblers, sunbirds, buntings, white-eyes, grass warblers, or smaller tanagers, shows that this factor can easily be exaggerated.

Large size may, in one way, actually favor song by making territorial needs greater, so that auditory communication must be effective and recognizable at greater distances, from which a larger number of possibly confusing sounds will also be heard. Large size also increases the possibilities for distinctiveness of sound-patterns, for a large bird can reach lower pitches without forfeiting the capacity for high ones (recall the lyrebirds). Finally, size is held by some biologists to favor brain capacity, and hence complexity of singing. One way in which intelligence makes complex singing possible is by increasing the capacity for learning by imitation. The very small yet superior singers deserve this rating more on grounds of musical exquisiteness than of versatility, though some are surprisingly strong in the latter also.

The smallest species of singing oscines are among the smallest birds of any kind at about 75 mm (3 inches), or in at least one case slightly less, the Weebill (*Smicrornis brevirostris*) of Australia. Eight songbird families have some species under 90 mm (3.5 inches). However, a number of families outside this group are equally small. At the opposite extreme, some oscines are rather large birds; for instance, ravens (who scarcely sing but have pair dialects and imitative powers) may be 700 mm (27 inches) in length. The oscine Lyrebirds, if one includes the tail may be almost a meter, or over a yard, long. In terms of weight, we have 1/5 of an ounce or less at the small end, and over a hundred times this at the other. The heaviest songbirds, the ravens (2 pounds), are apparently almost songless. Few creatures much larger than a human (except the humpbacked whale) are very musical. (There is a touch of music in the challenge of an elk.)

The capacity, confined to large birds, for deep "mellow" tones has the

biological significance that it enables the bird to be more readily heard in the midst of the mostly high-pitched small birds singing round it, and that low sounds are less obstructed by foliage, or other obstacles. But the lowered pitch is certainly agreeable for human beings. That the large Mistle Thrush (*Turdus viscivorus*) of Europe lacks deep tones is rather odd.

The relation of size to pitch is nicely shown by the possibility of ranging the voices of four American owls so that they make a series, each being smaller and an octave above the previous. Greenewalt (1968) points out that some large species have rather high-pitched voices. This is particularly true of hawks and eagles. It is much less true, if true at all, of owls. This is no accident. Owls are more like Songbirds in their use of voice, surely because of the low visibility in their nocturnal haunts. Their utterances also sound more like true songs. That hawks and eagles often lack the pitch range their size could have made possible is connected with the fact that vocal territorial or pairing communications are less needed because of that very size and visibility in their diurnal and aerial way of living. But most Songbirds have and use this possibility. Greenewalt does well, however, to make us aware that there is no exact or strictly universal correlation between size and pitch. Certainly the tropical American Black-bellied Wren (*Pheugopedius fasciatoventris*) is lower pitched, in comparison to the Oriental Mountain Tailorbird (*Phyllergates cucullatus*), than the slight difference in size would lead us to expect, and the Mistle Thrush is higher pitched than the comparably large Tui of New Zealand. Greenewalt also argues persuasively that the vibrating elements in singing are the paired internal tympaniform membranes of the syrinx, and that pitch range depends anatomically upon the thickness, and physiologically upon the muscularly induced tension, of this organ; finally, that the size of the bird need not in any strict and uniform way determine the thickness of the membrane, which thickness it is suggested, is a species-specific feature. However, I have no doubt that a broad statistical correlation obtains. For every large bird with a high voice one can find many with deep ones, particularly in species for which song is important, and for one small bird with a voice as deep as that of the wren mentioned above one can find many with much higher voices.

Greenewalt's own examples in general support the correlation in question. His lowest frequencies are from the Dusky Grouse (*Dendragapus obscurus*), Spruce Grouse (*Falcipennis canadensis*),

Greater Sage-Grouse (*Centrocercus urophasianus*), Great Gray Owl (*Strix nebulosus*), and American Bittern (*Botaurus lentiginosus*), while his highest is one phrase of the Brown-headed Cowbird (*Molothrus ater*), a much smaller species, and the species with the entire song very high (Blackpoll Warbler, *Setophaga striata* – 8.5 kHz to 10.5 kHz) is quite small (weight 1/2 ounce). Moreover the greatest pitch range, the cowbird's (700 Hz to nearly 11 kHz), is that of a medium-sized rather than very small bird. (The point is not that large species cannot have high-, but that small species can hardly have low utterances.) And this author's list of examples of small singing species with deep voices are without exception what, statistically speaking, are medium-sized birds, e.g., Mourning Dove (*Zenaida macroura*), "several small owls," and the Brown-headed Cowbird. His examples of large birds with high voices, Osprey (*Pandion haliaetus*) and Laysan Albatross (*Phoebastria immutabilis*) are not songbirds and are only minimally singers. The largest of the songbirds, the Common Raven (*Corvus corax*), has of course a deep voice, and crows in general have deep or medium-pitched utterances, as do the bell-magpies and Wattle Crows of Australasia. So the generalization, small singers are confined to higher pitches than large ones, is valid in the sense in which most careful biological inductions are, that is, allowing for many mild and some less mild exceptions.

Greenewalt has done us a service in giving a rational explanation of the long-known ability of birds to sing two notes simultaneously. Whereas some had supposed, I cannot imagine why, that both vocalizing membranes always vibrate together in the same fashion, he gives strong evidence that the bird can control the two independently. This is one of several ways in which birds are better endowed by nature to sing than even we are. Szoke, who argues for the better endowment, seems to have missed this point, and gives a different and probably erroneous reason.

Another important fact gleaned from Greenewalt's study is that birds that cannot sing what he calls "whistled" or relatively pure notes below a certain pitch (1.5 kHz or higher in oscines) may produce impure ones (which he perhaps oddly calls harmonics, but which are heard as noisy) at lower pitches. And there is the really low threshold (80-200 Hz) for pure tones he finds in large birds, the grouse, bittern, and owl mentioned. Here again we see that large size implies extra musical possibilities.

Songs may be audible at a distance of few or many hundreds of meters. Genuine territorial songs usually carry a long way. Perhaps the

most powerful of all, relative to size at least, are by a suboscine, the bellbirds of the New World tropics (*Procnias*, family Cotingidae). In this case "gongbirds" would be more suggestive of the pitch than the other word.

Birds sing in many locations, on the ground, low in bushes or trees, clinging to grass stems or reeds, high in trees, flying from one perch to another, soaring high in the air. Does any bird produce what could sensibly be termed a song while floating in water? It seems that one could say this only of loons, not perching birds. Thrushes usually sing from tree perches, but the Gray-cheeked Thrush (*Catharus minimus*) flies into the air from its relatively treeless northern haunts, and Townsend's Solitaire (*Myadestes townsendi*) near timberline in mountains flies and soars a good deal in its singing; also, at the opposite extreme, I have seen and heard a White-tailed Blue Robin (*Cinclidium leucurum*) in Malaysia sing its exquisite high-pitched music from the ground in its moist low-mountain forest home. Larks (family Alaudidae) and pipits (family Motacillidae) mostly sing in flight, but sometimes also from the ground or low perches. The American meadowlarks (*Sturnella*, family Icteridae, not true larks but relatives of the New World orioles) sing partly from the ground or low perch, but sometimes in trees and sometimes in flight. I suspect that members of a good many species occasionally sing in flight. Most buntings (families Emberizidae and Passerellidae) sing from perches, but Cassin's Sparrow (*Peucaea cassinii*) is an exception, habitually flying upward a few feet for its short song. The most comical of all flight songs, the bird rising less than a meter in the air and almost instantly returning to its perch, with the song little more than an exclamation at the peak of the rise, is by the Blue-black Grassquit (*Volatinia jacarina*) of Middle and South America. That flight songs are usually in open country is understandable; for in forest they would usually fail of their display effect. This explains the case of the solitaire mentioned; for its timberline haunts make its song flights quite visible.

It may seem odd that the flycatching species that forage from perches, rather than, like swallows, staying in the air for long periods, seldom sing in flight (at least in my experience). But perhaps it is not odd, since the flying would in this case have no distinctive meaning, would not be a "display," as it is also not in swallows. (These sing much in flight since otherwise they would have little chance to sing at all.) The case of the "flycatching thrush," as Townsend's Solitaire has been called, is a bit

different since its foraging is to a considerable extent on the ground, to which also it often flies from a post in a tree to pick up an insect observed from above, rather in the manner of some shrikes.

Song sometimes tells young in the nest that they are about to be fed. In some gregarious species of Old World finches, such as waxbills (family Estrildidae), song is used to restore contact not necessarily with a mate but simply with another individual of the species. This has been called "solitary song," song by a solitary bird that does not wish to remain solitary. If it can see a companion, it does not sing, but if none is visible it sings. Territorial song, usually helpful also in acquiring and maintaining relations with a mate, is the loudest form of song and the most definite in its patterns. It is also the one most readily studied. Song too faint to serve as territorial advertisement is easily overlooked. In many cardueline finches (the group that includes the goldfinches, crossbills, and redpolls) song is chiefly addressed to the mate, not rival males. But these songs tend to be rather simple, and none seems clearly of the highest rank. Even the Pine Grosbeak (*Pinicola enucleator*), while sweet, is not powerful, nor has it much scope or variety.

It is sometimes said that youthful warbling, before a bird has crystallized its utterances into sharply defined patterns, is more beautiful than the finished territorial song. It may indeed come in longer unbroken series, and perhaps be freer from harsh elements. But whether or not it is better music depends partly on how one evaluates clearly defined form. Clarity is a sign of intelligence, even in music. True, I have listened to incomparably less immature than mature singing and may not be a good judge. Those who raise birds in captivity have the best chance of studying immature song. In nature mature territorial songs are the obvious ones, and I rather think musically the best.

There are various forms of group or cooperative singing. The commonest form is "dual singing," or duetting, which is of several kinds. A bird and its mate may simultaneously sing the same or much the same song. This apparently functions as mutual stimulation, or reinforcement of the pair bond. In tropical America some cactus wrens (*Campylorhynchus*) and sparrows (*Aimophila*), exhibit this. The two birds may be only a few inches apart and see each other plainly. It is quite different where mated birds forage out of sight in dense vegetation and keep "in touch" by singing together. This often takes the form in which the male begins the song and the female furnishes the finale. The timing is in such cases

usually amazingly perfect, and no human being could react quickly enough to duplicate the feat which the female performs. In such "antiphonal" singing the female's contribution may be much less musical than the male's, or it may be comparably musical, as in the Tropical Boubou. I have heard the female (I presume) Grey Shrikethrush respond to the male's song with the same lovely melody in a different key, or at least at a different pitch. (I am not an expert on keys). The cactus wrens and American sparrows spoken of above, on the other hand, have harsh songs almost devoid of musical quality. But these songs are not primarily for identification at a distance, which I believe, with Joan Hall-Craggs, is the great factor favoring musical development. In cases where a song is divided between male and female either bird is capable of singing the entire song. This is not surprising, for to achieve such perfect musical cooperation both must grasp the entire pattern.

Trios and quartets are rare and harder to interpret. They may involve family parties, the young beginning to learn the game by participating with the parents. Then there are various forms of choral singing with indefinitely many participants. Species which are gregarious outside the breeding season may in winter or early spring, perhaps while or just before migrating, sing softly in a flock.

A rare form is the choral singing of bellmagpies (*Gymnorhina*; family Artamidae) which has been shown by Hugh Wilson to be territorial, but (somewhat as in the howler monkeys) the territories belong to a group of pairs not a single pair. The song must be powerful, since such a territory must be large. This may help to balance the rather showy black-white coloring of this genus. They are perhaps visible enough over ordinary distances but not over the distances required by their unusual habits. The kokakos (*Callaeus*; family Callaeidae) of New Zealand apparently belong in this category.

According to Walter Garstang (1923), music develops out of speech-like sounds, in both birds and people. What this means is that the sort of song that can be suggested by syllables, such as "Bob-white", "whip-poor-will", or "che-ree, che-ree, che-ree", is more primitive than the sort that one can only give an idea of by indicating what musical notes are involved, as for instance in the song of the Canyon Wren (*Catherpes mexicanus*), which descends the scale in rather pure musical tones, or the Hermit Thrush's song (*Catharus guttatus*), which is like a miniature piece of Bach, the whole interest being in the tonal intervals and harmonic

progressions. Between the extremes there are songs for which the speech-like elements and the pure-pitch relationships are about equally important. Garstang gives the European Robin and the Mistle Thrush as examples. The Common Nightingale is, he thinks, the supreme case of the primitive or essentially speech-like song. This is borne out by the sort of praise which has been bestowed on this bird. It is praised in terms of its variety of emotions, its skillful reiterations and contrasts, but who has praised it, strictly speaking, musically? What are the remarkable uses of this or that tonal interval, suggestion of a diatonic scale, major third, minor third, major chord, sixth, octave relation, melodic theme and its variations? The Common Nightingale is a supreme dramatic-poetic artist, but it is not very high among the avian tonal musicians. It is only middling compared to the Woodlark. The Thrush Nightingale (*L. luscinia*) is less syllabic.

Although I would qualify somewhat the negative side of Garstang's account of the nightingale, I agree with him that there are more musical songs, and that the purely musical song is less primitive. After all, speech-like sounds are easier to make, for they are closer to mere noises. Pitch control is cruder, less precise, in their production. Normal human infants (with very rare exceptions) learn to pronounce words long before they can reproduce a melody.

The nature of an activity or skill becomes in some respects more apparent in extreme cases. Hence I have thought a good deal about what seem the most "highly developed" cases of singing. If at least 3,000 oscines, and something like 5,000 species of birds altogether, can be said to sing - stretching the criteria for "song" fairly far - then the 4 percent of the latter or 6.6 percent of the former most highly developed cases, whether of the more speechlike or the more musical type, would be something like 200 species. These would be the "outstanding" or "superior" songs, not far from the avian upper limit. Of course no two persons would draw up the same list, but there would be much overlap, and many items would be on every careful list. And it would be rare for two listeners to a song, who were not thinking merely of their own pleasure in hearing it, but of objective reasons for their admiration, such as complexity and tonal purity, to disagree so extremely that one would call "very poor" what another called "very good." I consider all the birds which have been highly praised in any of scores of countries to be at least good, rather than poor. Time after time I have gone to a country after poring over the bird books to find the likely candidates for my list of the 200 best

songs. (Only once did I hear a song I was inclined to rate superior which had apparently never been strongly praised. This was in Fiji, about the songs of which there seems to be almost nothing published). Often, before visually identifying a singer, I guessed what it probably or almost certainly was from the location plus the superior quality. Sometimes I would not have troubled to identify it had this not been the case. It is simply false that the concept "highly-developed song" is subjective, if that means merely personal (and it is false even if it means only "anthropomorphic"). It has some degree of subjectivity and a substantial degree of objectivity.

Those who, centuries ago, pronounced the Nightingale the finest of the world's songsters literally did not know what they were talking about, for they were not acquainted with anything like most of the world's singing birds, but only with a small minority of them. We begin to realize that, to speak loosely, nature made many nightingales. By means of recordings there may well, within a few years, be available for adequate hearing one hundred or more superior types of avian music. (Since this was written, the prediction has been fulfilled.) We shall become aware of what a vast panorama of musical "compositions" are involved, each limited, to be sure, to a small handful of exquisite or at least pleasing musical effects, yet in the aggregate covering a sublime range of contrasts - songs merry and songs plaintive or solemn, high-pitched songs well above the piano, but also deep mellow songs (sung by certain rather large birds, especially in Australasia, songs exhibiting every kind of simple rhythmical pattern, every harmonic interval, numerous tiny melodies, bell tones, flute- and fife tones, gong-like sounds (New World bellbirds, *Procnias*, family Cotingidae), guitar-like sounds (Bobolink, *Dolichonyx oryzivorus*), xylophonic sounds (African tinkerbirds, *Pogoniulus*, family Lybiidae) - almost what you will. It is a beautiful totality to think of, with the very musical values we could wish it to have. For anything further would render birds superfluous rivals to ourselves as musicians. It is the simplicity, the naivete, of the songs which makes them valuable to us. Musical sophistication we can supply; but the absolute absorption in the elementary possibilities of music, in each tiny fragment of exquisiteness, as though it constituted the fulfillment of all need, this contentment with a restricted, minute, but in each case genuine and unique good, this perfectly bounded but unalloyed and patterned happiness, from this we can derive refreshment and perhaps even a certain wisdom.

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A Note on Scientific Names and Literature

In this essay Prof. Hartshorne often refers to various formal categories into which the birds of the world are classified. The basic category of classification for all animals and plants is the species, which often corresponds to most people's notion of a single kind of creature: a Northern Cardinal or a Carolina Wren, for instance. Scientists currently recognize about 10,000 species of birds. Several similar species are grouped into the next higher category of classification, the genus (the plural is "genera"); the birds make up about 2,000 of these. The name of a genus is always capitalized and italicized. Examples are *Poecile*, the chickadees; *Sialia*, the American bluebirds; and *Corvus*, the crows. The standard scientific name or "binomen" of a species is formed of two words, the name of the genus to which it belongs and a species "epithet" (not a derogatory term here) that distinguishes it from the other members of the genus. For example, the Carolina Chickadee is *Poecile carolinensis*; it is placed in the genus *Poecile* with about 13 other species, each of which has its own unique combination of the genus name and a species epithet, such as *Poecile rufescens* for the Chestnut-backed Chickadee. The scientific name is sometimes shortened by abbreviating the genus name to the first letter, such as in *P. carolinensis*. Genera are grouped into the next highest category, the family; there are about 140 of these among birds. Family names end with "-idae," and are not italicized. *Poecile*, for instance, is grouped with several other genera in the family Paridae, the titmice and their relatives. Other examples are the Turdidae, the thrushes and bluebirds; and the Corvidae, the crows, jays, and their relatives. The birds in a given family are sometimes referred to by the family name without the "ae" ending, with in some cases an

"s" at the end to indicate the plural; thus we can say that an individual bird or species in the family Paridae is a "parid," or that several individuals or species in that family are "parids." When lacking the "ae" ending in this way the name is not capitalized.

Families are grouped into yet larger categories called "orders"; among the birds, there are about 23. Prof. Hartshorne often refers to one particular order, the Passeriformes. The birds of this order, also called the passerines or perching birds, are the ones most people think of as having typical tree-living-bird shapes, such as flycatchers, thrushes, wrens, tanagers, and warblers, but they also include other types of birds, such as woodcreepers and antbirds, that are less familiar to residents of the north-temperate zone. The passerines are defined with gratifying simplicity by the possession of four toes, with three arranged forward and one backward, all on the same level. They make up at least half of the world's bird species. The passerines are divided into two groups ("sub-orders"), the sub-oscines and the oscines, based upon features of the birds' vocal anatomy, which has a direct effect upon their ability to sing. The sound-producing organ, the syrinx, is outfitted in passerines with as many as four pairs of muscles that change its shape to produce a variety of sounds; the more pairs a bird has, it is thought, the greater is its potential to produce complex song. The sub-oscines have a maximum of two such pairs, and include the flycatchers, woodcreepers, and antbirds. The oscines, also called the true "songbirds," are equipped with three or four pairs, and include the thrushes, wrens, tanagers, and warblers, among many others.

I have brought up to date the scientific names, including family names, for the birds Hartshorne mentions, and have added a few where he had not provided them, except in one passage that would have become tiresomely overcrowded with technical terms had I done so.

The books and articles to which Prof. Hartshorne refers in this essay are not all the most recent ones on the subjects he discusses, but they give a now-unusual look into some of the older but still-insightful works this scholar drew upon in his more than 80 years' study of bird life.

--Tom Webber