CHAPTER 6

Rhythm and Detail

Resemblance brings the first glimmer of understanding. I know this song, it sounds like something I've heard before. No wonder mimicry was the first aspect of bird song structure to receive close attention. Delving deeper into song's complexity requires years of close listening and observation, in the fickle wild, not the bounded cage. Those who have risen to such a challenge have been obsessed with their subject in the best sense. Through meticulous work they struggled to learn how it feels to sing like a bird and know the rhythm and detail of the song itself.

No student of bird behavior has been as diligent as Margaret Morse Nice of Columbus, Ohio, who spent eight years in the 1930s precisely recording the movements and activities of all the song sparrows on the flood plain behind her suburban house, a forty-acre tract that she christened "Interpont." With a minimum of equipment and a maximum of enthusiasm, she pursued a quandary that possessed her ever since she studied with Konrad Lorenz in Vienna: Were birds like machines who responded instinctively to their surroundings, or were they capable of planning their actions? She aimed for what philosophers call a *phenomenology,* paying direct attention to the happenings you see with as few preconceptions as you can make do with.

Nice learned every inch of her backyard study area and how it was divided up by her subjects. She mapped out the territories of each bird, putting bands on their legs so she could tell them apart. Each was given a number-and-letter code name, with all their comings and goings dutifully described. All kinds of variation in behavior were observed. Some of the birds migrated and left each winter, others did not. Most chose different mates each season. One male even mated with his sister for a time. Her detailed report of all this activity fills two volumes, more than 500 dense pages. No comparable study on a single bird population has ever been published before or since.

Song is vital to song sparrows—their Latin name is *Melospiza melodia,* meaning "melodious singers." Mathews, in his field book of transcribed bird songs, considered them the "best exponents of the song motive among all the members of the feathered tribe." Saunders of the squiggly neumes praised the pleasing and attractive nature of the songs, which he found more persistent and frequent than those of any other common songbird. Song sparrows begin with one declamatory rhythmic outburst and then move on through related rhythms in a microcosm of two seconds or less. The phrases are intelligible and clear, often resembling familiar themes from human music. Nice heard the beginning of Beethoven's Fifth. Mathews heard Verdi's *Rigoletto:* "*La donna è mobile!*" Or "wail, wail, fickle wife is she, flown away and left me!" "Sad, sad, what a tale of sorrow! She may return tomorrow." Or in bird words, *Wertz, wertz, wertz, weet-weet-weet-weet-weet-weet spee-ge-wee-ge-dee.*

As in the song of the thrasher, each phrase is a little bit different, but they all have an identifiable song sparrow essence. The males Nice studied had between six and twelve songs. Saunders classified more than 800 records of song sparrow songs and found that most males have either nine, twelve, eighteen, or twenty-four song motifs, strangely enough often in groups of three. For the three males that nested right in her garden—1M, 4M, and 187M—Nice wrote down all their phrases. 1M had six songs, including *chip chip chee yer zig zig*

zig zig; chee chee chiddle hair terpée terpée terpée; and *tee tee tee eeeyer huffum huffum huffum.* 4M had nine, among them *spink spink spink spink ereteree* and *hur hreeeee tweet tweet tweet tweet tweet.*

Nice knew of Saunders' notation but found it too technical and idiosyncratic for her purposes. Song sparrow songs are supposed to have a three-part structure, beginning with a few rhythmic notes, then a series of trills, and more unpredictable ending notes. She heard much more variation than that. For 288 hours she recorded all the singing done by those three birds closest to her home. Her book reports all kinds of specific conclusions in paragraphs like this one:

> A song sparrow usually goes through his whole repertoire before repeating any one song; the order in the second series is rarely repeated exactly. A bird with 6 songs gives 2/3 of them in an hour in the inhibited state, all in the uninhibited state, all and half again in the stimulated state, and twice over in the highly stimulated state. A bird with 9 songs will present them all in the stimulated state and do the same with a start on a second rendition when highly stimulated. I do not know what pattern is followed by a bird with 24 songs.

There are hundreds of pages of data such as this, with few of the complex statistics favored by more recent bird song science. Nice is more interested in the quality of observation than the quantity. She would rather elucidate than enumerate.

Despite her desire for uninhibited observation, Nice was obviously impressed by the latest ethological theory of her day—namely, Niko Tinbergen's assertion that bird song is much more about defending territories than about attracting mates. This fits her observations: male song sparrows sing most intensely when showing off to other males, announcing their boundaries, defending their zones. Singing cools down but still continues after the eggs are laid and the females are guarding them on their nests.

> While his mate is incubating he gives a "signal song" for her to come off the nest—a sign that all is well and he is ready to guard. He sings

near the nest while she is off, a warning that he is ready to drive off intruders. His singing while she incubates may be an expression of satisfaction that all is going well, a method of passing the time when he is alone. While caring for young, there is little energy for singing, except for single songs after feeding the family, and especially after carrying off excreta. The fall singing in fine weather would seem to be an expression of excess energy.

Singing in the sun just to let off some steam? Nice quotes the great biologist Julian Huxley's view that bird song goes on beyond its functions. "Song," says Huxley, "is simply an outlet, and a pleasurable one." Birds "continue to sing in all moments of excitement or exaltation." Exaltation? Is that something a scientist can determine? Nice's birds turn out to be more than machines. They are animals with excellent memories—of territory, of songs heard, homes to return to, and strong emotions—*feelings* explained by a mixture of instinct and learning.

Consider the various "methods of intimidation"—in both sound and stance—that Nice observed in her song sparrows. Tall, erect posture, for the full advertising song, announcing "here I am, this is my place. These are all the songs I know." Antagonism, with an open bill. Menace, with lowered crest, crouched body, extended neck, beak pointed at the enemy. Threat posture, with feathers ballooned. The challenge—"puff-sing-wave"—wings vibrating, slow hovering flight in place. Finally the intriguing courtship behavior of *pouncing,* when the male darts down, nicks a female, and flies off with a song, aggressively, letting her know he's interested. Mating itself doesn't come until weeks later.

Nice's favorite singer was 4M, whom she observed very closely through his life of many years beginning in 1928, charting his series of different mates and skirmishes with neighboring rival males. She recounts his dramatic final season at Interpont: By 1935, after years of successful broods, 4M was having trouble finding a mate, and finally ended up with one that Nice didn't like very much, so she left her scientific pose to name her after Socrates' shrewish wife. This female bird was a "cold old-maidish creature, tyrannizing over her fine husband like a veritable Xantippe." She often made secret forays over to a nearby male, 225M, and 4M often had to run over and nudge her back home. She was lazy about nest building, and when she finally did, she laid only two eggs. Some wrens came by and poked them, and eventually Xantippe left. Mrs. Nice said good riddance.

Five days later, on May 11, 1935, 4M did something that Nice had never observed in all her song sparrow studies. Beginning before the sun came up, he put forth an incredible outpouring of song that kept on all day until after the sun went down. Beginning at 4:44 A.M. with song D, he launched into his cycle, with five songs a minute, two hundred per hour, on and on tirelessly through the day. Grief? Longing for a new mate? Relief? Remorse? "Excess energy"? What was it all about? He did not find another mate but kept singing in a more guarded way for a few more weeks. Late in summer 4M departed. He never returned to Interpont again. Nice had watched him find eleven mates, build seventeen nests, and raise thirteen chicks. He was widowed seven times.

How do Nice's conclusions compare to more recent studies of the song sparrow? After all, she did not have tape recorders or sonograms to back up what she heard in the songs, only her ears, eyes, and time on her side. She conducted no playback experiments to test birds' responses to different variations of their own songs. She relied entirely on her powers of discrimination—might the birds have their own criteria of the same and the different? Perhaps what we consider to be distinctions in song type really don't matter to them. Maybe they hear other variations we cannot.

Song sparrows are excellent birds with which to investigate such questions. They thrive among humans and are somewhat tame and easy to watch. They have a complex song, but nothing that taxes our listening abilities like the starling or the marsh warbler. Each song sparrow has at most thirty song types, and they repeat them in a regular order. This is much easier to track than the extensive performances of catbirds and nightingales. Song sparrows also share some of their repertoire with their neighbors, and this sharing can be quantified and measured. Among males with larger repertoires, there is greater similarity between the different songs. Unlike thrashers and mockingbirds, song sparrows cannot learn indefinitely.

In the eary nineties a group of scientists, led by Peter Marler and Jeffrey Podos, tried to divide sparrow song motifs into the smallest unit of organization, either single notes or groups of notes that always occur together and in sequence. They called these "minimal units of production," which sounds more like an industrial term than a building block of music. Through playback experiments, they found that males react more intensely to differences *between* one song type and the next, rather than to subtle variations of the same type, something that Kroodsma had previously suspected. The scientists were sensitive to the units of production, but the sparrows weren't. Rather than categorize their own songs as being composed out of building blocks, they were more interested in change from one song to another.

Another experiment showed that if you play a song sparrow one of his neighbor's songs, he will not reply with the same motif but with a different riff from the list that he shares with that neighbor. The researchers called this *repertoire matching,* as opposed to *type matching.* (Scientists often invent or redefine their terminology with each new article in the hope that their colleagues will follow their new terms. Often they don't.) But if the male sparrow hears a completely alien song from a stranger sparrow, not a neighbor, then he will try to match that song with the closest type that he can! Whatever for? Some have concluded that matching with a similar type of song is somehow more aggressive than trading common phrases with the neighbor bird. It's like two jazz musicians meeting on the stand. One is soloing over "My Favorite Things," and the other starts to jam over the same chord changes at the same time. That might suggest a contest. But if the second player says, "Oh, I know that guy. He loves the tune 'Summertime,'" and then switches to "Summertime," it's a friendly response, demonstrating respect, not a need to win. Song sparrows seem to recognize these two ways of singing together.

The team tried a third experiment. If copying is more aggressive than riffing, then it should be more prevalent early in the season, before mating, when birds are spending more of their time in aggressive territorial defense. Seventy-three percent of the time this turned out to be true. Whereas Nice and Saunders heard magic groupings of songs into 6, 9, 12, 18, and 24, researchers armed with the latest technologies did not find playlists divisible by three. But they did get closer to the birds in one way that earlier observers did not, by showing that what mattered to the singers was something that did not so much impress human observers looking for basic rules. Where people looked for similarity, the sparrows wanted difference. Podos and Marler found this out by playing their own songs back to the birds and watching what they did.

The use of playback as a technique in bird song study is clearly one of the great advantages sound recording technology has given the scientist. Yet science itself has expressed some serious reservations about the technique. Don Kroodsma was the first to point out this danger: If you want to see how a bird will respond to an unfamiliar song or sound, you can play him or her the sound. The first response will be to something unfamiliar, but pretty soon your subject gets habituated to the sound. Judging the relevance of the reply gets complicated. What did Kroodsma suggest? Don't just use a single playback sound, but a series of playback sounds that are slightly variable. Then you might be able to avoid what he calls *pseudoreplication*—testing for one thing while actually getting a result for something else. The bird may get too used to your tapes and no longer treat them as something worth responding to.

The song sparrow experiments reviewed above were all done after Kroodsma's critique, and in a later review he praises them for the care with which they were conducted. Nevertheless, they are still artificial situations. They test for specific hypotheses in constrained conditions. They are not the results of disciplined observation of how birds actually live and sing in the real world. Their conclusions will always be statistical and tentative.

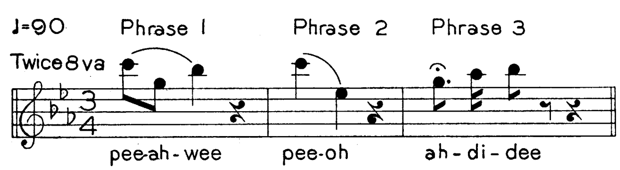
Playback experiments may be closer to art than to science, nearer to interspecies music than rigorous test. Play a clarinet to a bird and listen to what happens. From the first note I'm messing with his sonic world. I don't want to prove anything, I am only trying to forge a musical link. Trying to learn from the bird's ways without so simple a model as me copying him or him copying me. There are many more possible reactions than that. The song sparrow story gives me hope: I want to share exuberance, adventure, and some common cause of music for its own sake. Perhaps the bird may learn that he and I like the same kind of songs.

But remember that each species is unique, with a particular musical culture. We cannot quickly generalize from this kind of sparrow to any other bird. Consider instead a long solo song, sung on and on in clear patterns. The longest monograph on a single bird song is not about a complicated learned song, but instead a series of brief melodies composed out of three notes, probably innate and not learned at all. In 1943 Wallace Craig published a special issue of the New York State Museum Bulletin entitled "The Song of the Wood Pewee . . . : A Study of Bird Music." It is nearly two hundred pages in length.

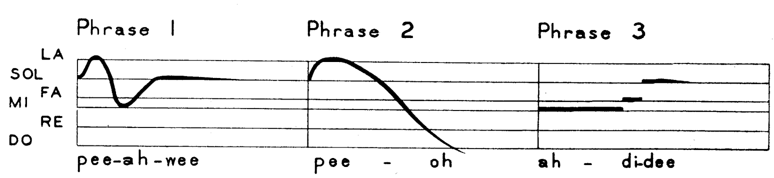
The eastern wood pewee, a small gray forest flycatcher, sings only three simple phrases, combined in a series of clear groupings, easy to note and identify. Why did Craig choose to devote so much attention to so simple a song? Because it sounded pure and beautiful to his ear. None of the endless variations of the thrasher or mockingbird; no complex sound-matching society life like the song sparrow. What was so musical in this delicate pewee clarity?

Craig gathered twenty-two observers from across the eastern and midwestern United States. Together they amassed 144 records of the morning twilight song, a total of some 93,000 phrases. What an incredible amount of pewee music to consider! What did they find? The wood pewee's morning song lasts between 16 and 32 minutes, with an average of 24. The typical song contains 750 phrases, the longest, 1,273. The song follows a definite pattern among the three possible phrases. At any one moment there is a tendency to move between one pattern and another, like those thrushes whose motifs follow each other according to a Markov chain. Craig sees not a mathematical tendency but a musical one. Like true music, the song sings of nothing beyond itself. "While singing the twilight song, the pewee is more or less isolated from the practical world."

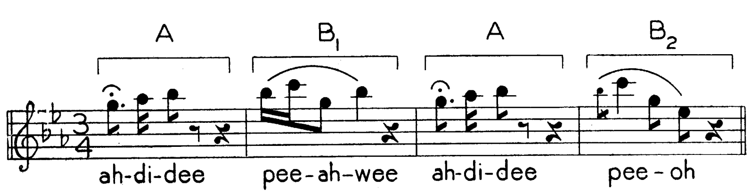
To catch the very beginning of the pewee's twilight song, you must arrive in the solid darkness of late night. First the bird begins with one sleepy call. Then silence for several minutes. The sky imperceptibly lightens. The wood pewee, says Craig, is attuned to the early morning changes in the forest, the trees, and all of its other inhabitants. Gradually the singing becomes more intense, even incessant. The three phrases are repeated one after another, in all manner of combinations. Here is how Craig identified the early song's components:



The three phrases of the morning twilight song



Graphic representation of the three phrases



The sentence *3132,* the wood pewee's most perfect sentence.

Record of morning twilight song by Saunders's Thirteenth,
Fairfield, Conn., June 25, 1932.

(Arrived at 3.24 a.m.) (About 3.44 a.m.) 1 1 1 12 312 312 132
31312 312 3132 31312 3132 (31312 twice) 3132 (31312 four times)
15th 36th 50th
3132 (313132 twice) (31312 twice) 3132 (313132 eight times) 31312
74th 86th 100th
3132 313132 31312 3132 (313132 six times) 3 1 3 312 3 1 3 312
157th 172d 208th
3132 (313132 eleven times) 1 . . . 2 3 1 3 3 2 13132 (313132 twice)
224th 293d 302d
3133132 (313132 twice) 3 1 3 312 3132 (313132 twice) 3133132
314th 321st 343d 355th
3132 313132 . . . 1312 (3132 twice) 3133132 3132 3133132 3 1 3
384th 395th
312 3132 3133132 3132 3133132 313132 3 1 3 3 2 1 3 (3132 twice)
412th 423d 437th 443d
3133132 (313132 twice) (3133132 twice) 313132 - 1 3 1 - 12 3132
451st 458th 470th
3133132 313132 3133132 3132 (3133132 thrice) - 1 3 312 3132
499th 512th 523d
(3133132 twice) 3132 (3133132 twice) 313132 3 - 1 - 2 313132

PARTIAL RECORD OF PHRASES IN
ONE WOOD PEWEE'S DAYBREAK SONG

Craig even employed Aretas Saunders, whom he considered the nation's greatest expert on bird song, to write down pewee songs for him. Above is the first half of what Saunders heard on June 25, 1932, starting at 3:42 A.M. You see anything but randomness here. The most common pattern is what Craig calls "the wood pewee's most perfect sentence"—3132 as composed of the numbered phrases above. "Are they gone? I don't know. Are they gone? No." That's mnemonic language, but Craig hears music. He wonders what it would take to understand the musicality of this balanced, complete sentence. Here's what he decides: Phrase A is a fragment, a musical question, looking onward for an answer. Section B_1 pushes on toward an end, but at the last moment turns up. The question again, and with B_2 a more complete, descending, landing answer. AB_1AB_2—a popular human song form, first noted in the pewee by Henry Oldys in 1904, who compared it to "Way Down Upon the Swanee River." Tell that to the starlings, eh? Craig believed that the "perfect" 3132 sentence is the most highly evolved form of bird music known to human ears.

Craig concluded that the rhythmic song of the wood pewee, sung long and leisurely through the earliest morning hours, is a true music, not just an outpouring of raw emotion. The pewee's whole demeanor while singing before dawn expresses calmness and lack of excitement. The bird sings in the dark and is wholly wrapped up in the song. He is as obsessed with his own music as those twenty-two human listeners who listened for many shadowy hours to take it all down.

There is no other scientific study with the stated aim that "our chief interest is in bird songs as *music*." Craig believed most previous bird song studies were too concerned with the function of song and too little with the qualities of the song itself. The situation hasn't changed much since—only Hartshorne's *Born to Sing* and the book you are now reading are the heirs to Craig's unique direction. Who was Wallace Craig and how did he end up seeking music in such an unlikely place?

Craig's most famous work is a 1918 paper called "Appetites and Aversions as Constituents of Instincts." This is one of the most coherent early arguments against the idea that animals are simply reflex machines, responding automatically and predictably to the same stimulus every time. Instead, Craig postulates a view of birds as living through a series of overlapping cycles of behavior. Eating, defending, mating, singing—each cycle competes for attention and has its own appetities to be satisfied and fulfilled. The bird's attention waxes and wanes from one to the next.

By the time he took on the wood pewee, Craig had been studying bird behavior for more than thirty years. Through his work on doves and pigeons, he was an early proponent of the view that birds, like other animals, were far more complex than earlier ethologists had thought. Margaret Morse Nice had introduced Craig to her teacher, Konrad Lorenz, who wrote in his autobiography that "Wallace Craig became *my* most influential teacher. He criticized my firmly held opinion that instinctive activities were based on chain reflexes." Craig convinced Lorenz that organisms do not react automatically to the same stimulus each time it is given. Instead, as soon as the stimulus appears, the animals begin at once to actively seek the situation for release. Still mechanistic, but not blindly so.

Lorenz is most popularly remembered for the notion of *imprinting* that leads baby geese to follow their keepers around, believing them to be their mothers. He also presumed that the wing spots on ducks came in such odd colors not because they were beautiful, but because they were the most *improbable* colors, perfectly tailored to generate the appropriate reaction of species identification in the receiver. So, wrote Craig to Lorenz in 1940, is this the same for the specific musical intricacy of bird song? Is there no more to it than improbable accident? Here's how Lorenz responded:

> I am very far from interpreting everything as a releaser and I have begun to have my doubts about the releasing function of the *details* of bird song. . . . It is certainly more beautiful than necessary and in this is akin to human art in general. Art *is* a fact and after all it would be rather ridiculous from our evolutionistic ideology to deny the possibility that something similar may occur in other species

There you have it, from the master ethologist himself: art is a fact. Craig still firmly believed instinct guided the pewee's song, and it is probably true that the young pewee, as one of the flycatchers, may inherit his song and not need to learn it from adult tutors. Craig's methodology was listening, and he worked hard at it, even claiming to hear the process of evolution at work in the pewee's song. Craig believed that the specific three-part song structure evolved because it is "musically suitable for singing in a continuous rhythmic song." He believed that the *tendencies* toward these phrases were older than the phrases themselves.

Phrase 3, says Craig, evolved to continue for many minutes and hundreds of repetitions. Musically it seems to reach onward and upward. Phrase 2 has finality but no clear rhythm. It evolved for leisurely daytime singing, which came first in the bird's development, later incorporated into the more intense predawn song that is unique to this species. It is also sung by the *western* wood pewee, which Craig considers an older species because it does not have the distinctive and more stylized morning song, lacking phrase 1. Phrase 1 is a compromise between the other two phrases, the result of a penchant for quick tempo and something akin to Hartshorne's monotony threshold—revealing a preference for delicate balance between repetition and novelty.

A pewee can *ah di dee, pee a wee, ah di dee, pee oh* all through twilight, leaving no listeners bored. The song is designed to resound on and on. This bird has evolved a propensity to continue, to sing the sun up in the earliest hours of dawn like Orpheus with his lyre. In this generating motif of an ancient music, Craig hears proof of an aesthetic principle as part of natural selection. He's the only one who has investigated what Darwin imagined was there.

The main line of bird song science, if it acknowledges Craig at all, sees him as a curiosity. "This whole field," said Don Kroodsma to me, "is full of people pushing their own pet theories." They cite the evidence that supports their views and ignore ideas that are too tough to prove. Craig heard music where other scientists heard *units of production* and *packages*. Aesthetics, he reminds us, is far more than prettiness. It is unassailably the result of evolution. Bird song is music not for us but for birds, and don't expect it to be encapsulated by biology. Future bird science ought to consider musicality in its investigations of song. Kroodsma laments that so few scientists have agreed. He said, "I've studied bird song for more than forty years, but I don't know a thing at all about music. Perhaps it's time to change that."

On the other side of the Atlantic, there was one man who tried. In the middle of the green forests of Finland, the zoologist and insect specialist Olavi Sotavalta came across a copy of Craig's voluminous pewee report and recognized its challenge. Sotavalta wondered if he might try out the approach of musical analysis on a genuinely complex bird song, that of the thrush nightingale, *Luscinia luscinia,* an

THE NIGHTINGALE

eastern European and Asian bird with a more rhythmic and scratchy song than the *Luscinia megarhynchos* nightingale of western Europe's romantic poetry. English nightingales sing fifty to two hundred different phrases with much variation and change. Sotavalta noted that thrush nightingales sing an equally large number of distinct phrase types, but each type has a fairly consistent structure more stylized than the phrases of the more famous bird.

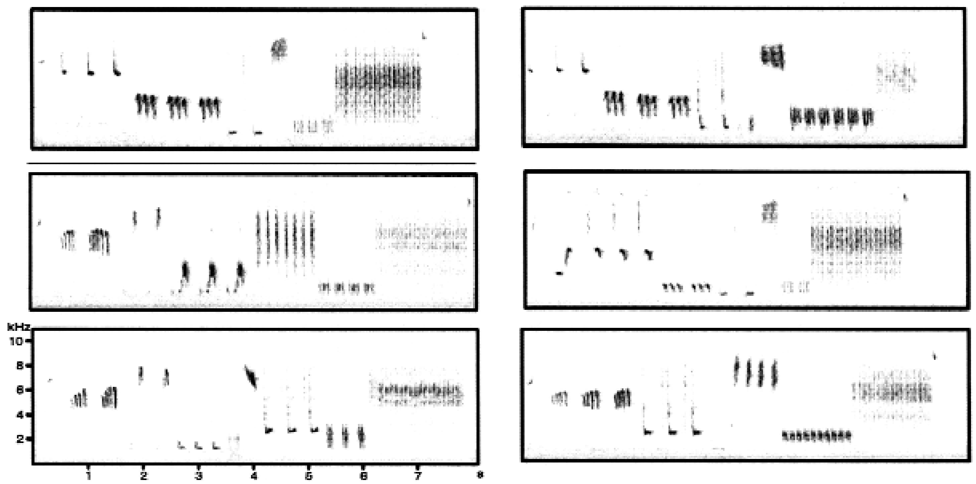
Sotavalta was a rare breed himself—a zoologist gifted with perfect pitch, thus uniquely qualified to transcribe what he heard with no special technology. In the 1940s he compiled a list of the different wingbeat frequencies of all the flying insects he met, just by listening to the tones zooming by. He trained himself to distinguish the fundamental pitch from the overtones. His list of these frequencies is praised for its accuracy and still used today. Cornell entomologist Tom Eisner remembers hearing Sotavalta lecture at Harvard in the 1950s, and said that he resembled an Old World monk: tall, bearded, dressed in a long cape like a character from another age.

Inspired by Craig, Sotavalta listened intently to the nightingale's song. Its timbre is not easily harmonious, but raw and complex, combining percussive rhythms and clear notes: "Pure tones could be whistling, piccolo-like, dull, like a low flute, metallic, celesta-like or chippy, like a xylophone, long or short." He struggled to put it in words. "The commonest noise-type appeared in the cadence and resembled the rattle of a tambourine."

The most salient quality of the thrush nightingale song is a series of specific pulses, a general pattern of which pervades each phrase the bird sings, which Sotavalta calls a *period,* synonymous with Craig's *sentence.* I'll call it a phrase, to keep the sense of the bird's whole performance as one long song. Sotavalta studied two birds—one in 1947 and the second in 1948. The first had fifteen basic phrases, and the second, seventeen. At the level of the phrase, a definite form can be identified. In the thrush nightingale song the rhythm seems more significant than the pitch. Here is the basic structure Sotovalta identified that fit nearly every phrase of both birds:

The introductory notes are one or two soft whistling tones. Then a low-pitched antecedent, then a brief link to the characteristic motif, which is the part most distinct between one phrase and the next. Double or triple time, sometimes distinct wide intervals. Then a postcedent series of repeated low notes, a high *bleep,* final "chippy, xylophonelike chords," and that one quick tambourine-type rattle. *Chhuum.* Thrush nightingale deciphered? At least some structure found. Below are four of the fifteen basic phrases Sotavalta heard from one of the birds. The revelation of a drumbeat music more resembles a battery of percussion than a luminous turn of melody. With all the praise given to the nightingale's virtuosity, it is amazing how weird its music looks and sounds. Compare this wild shaking and shifting to a more modern sonogram of several phrases from the same sort of bird, this from a recent study by German biologist Marc Naguib (see next page).

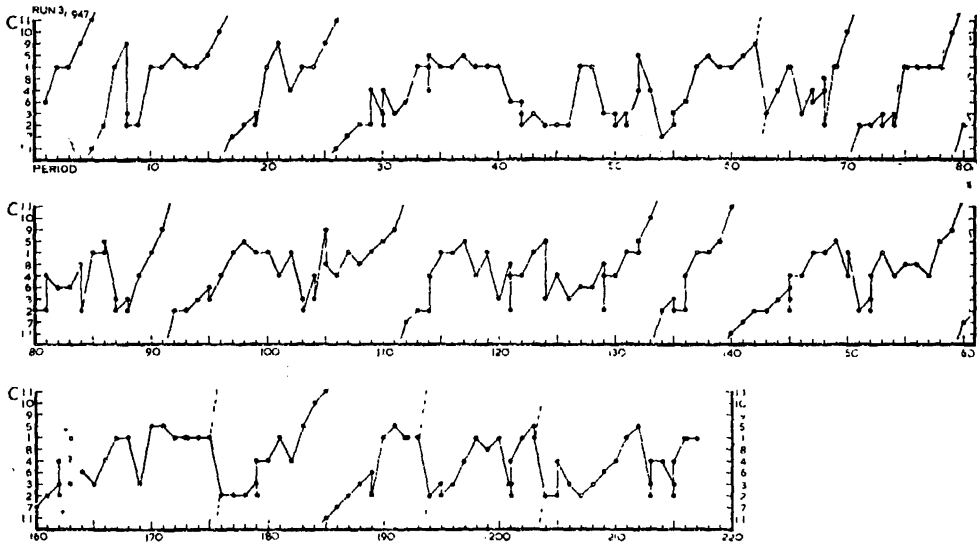
FOUR OUT OF THE FIFTEEN PHRASE TYPES OF SOTAVALTA'S THRUSH NIGHTINGALE



NAGUIB'S THRUSH NIGHTINGALE PHRASE SONOGRAMS

In this case the musical notation shows more nuance, even if it looks too human. Sotavalta analyzed the sequence of phrases in detail and concluded that the bird went through his phrases in a loosely patterned order. There were cycles upon cycles in the structure of the whole song, but each series has some variation. There was a sense of a regular progression through the repertoire, but no sequence of riffs was precisely the same as the next (as the jagged line on page 133 shows).

Sotavalta listened acutely and perceptively to decode the structure of the thrush nightingale's song. He found clear rules in it, yet no line of research was based on his conclusions. Like Nice and Craig, he was a maverick listener, off the main track of sonography, playback, and enumeration. Later nightingale researchers scoffed at his sample size of only two individual birds! And he used a kind of musical argumentation that is difficult to quantify. Yet he traced the secrets of nightingale music more accurately than anyone since. He revealed perhaps why so *little* Western music has actually been based on nightingale song, despite the vast metaphorical power of this bird's image. But the nightingale has been revered outside science, all over the world.



SOTAVALTA'S GRAPH OF SUCCESSIVE SEQUENCES OF PHRASE TYPES SUNG BY THE SAME THRUSH NIGHTINGALE

Nightingales have long had a central role in the musical mythology of Persian culture, within the boundaries of the modern countries Iran and Afghanistan. It is the bird of a thousand stories, *hazâr dastân,* singing turn by turn, *rad bâ rad,* always changing its song. Calling a musician a nightingale is the highest form of praise—the greatest often have the word *bolbol* added to their names as an ultimate honor. In less fundamentalist days, when music was not chastised or banned, bird song was considered a form of *zikr,* or remembrance of God, like a muezzin's prayer. The meaning echoes more in the repetition than in the words themselves. All bird species have their own *zikr,* all praising Creation, and the *bolbol* is the master bird who never repeats himself, always coming up with new names for God. This gives bird song the highest honor in a devotional culture, a loftier purpose than biology has so far allowed.

Despite this reverence, Afghan musicians have not made much specific use of bird song in their melodies or forms. John Baily, one of

Europe's greatest authorities on the musical culture of Afghanistan, brought a recording of English nightingale song and played it to some Afghan refugee musicians living in Pakistan in 1994. They were immediately excited. First they responded to the taped bird song using the "drum language" of spoken *bhols,* in which players speak the patterns they later play on the tabla. Although no one had noticed it before, the birds' phrases fit right into the sixteen-beat recurring *tintal* cycle that is the most popular 4/4 rhythm in that part of the world. *Dha Ti Ta Dha / Ti Ta Dha Ti / Dha Dha Ti Ta / Dha Dha Tu Na.* Then they got out their tabla drums and *rebab* violin to jam along with the tape. To the drummers, the nightingale's phrase was a fully stuctured tabla solo, easy to assimilate and respond to. But their tradition had not explicitly made use of nightingale rhythms before. The end result sounds like a new kind of interspecies music, part nightingale—with the relentless call-and-response not trying to go anywhere or conclude—and the musicians caught in the web of the challenge, trying to play exactly what is heard and to take it to some other, human level.

In Iran, in the Persian music tradition, there is a kind of musical ornamentation called *Tahrir-e Bolboli,* where singers and their accompanists imitate one another with rapid trills and nightingalelike quips. Here is a tale about one of their most famous singers, named Qamar:

> Once upon a day Qamar went to Darband, a scenic place near Tehran, to take a walk and practice in the open air. Qamar started singing Tahrir-e Bolboli while she was walking among the trees. A nightingale sitting on a branch heard her beautiful song and began to sing along. The nightingale was trying to sing like Qamar, and Qamar was trying to sing like the nightingale, just as singers and players meld together in traditional Persian music. The fever rose as they each tried to sing faster and louder. Suddenly the nightingale fell down and died, because it could not keep up with the great Qamar. Qamar cried deeply for two days. She could not forgive herself for having killed a bird with music. Was all this beauty and intensity nothing more than a

fight to the death? Song, whether coming from birds or from humans, must be more than war.

The yearning of the nightingale figures prominently in the famous Sufi fable of Attar, *The Conference of the Birds,* among the most known works in all of Persian literature. The master of birds, the gaudy Hoopoe, is trying to assemble all the other bird species to join him on a quest for the sacred valley. Here's how the nightingale answered the call to join up:

> The amorous Nightingale first came forward almost beside himself with passion. He poured emotion into each of the thousand notes of his song; and in each was to be found a world of secrets. When he sang of these mysteries all the other birds became silent. "The secrets of love are known to me," he said. "All night I repeat my songs of love. Is there no unhappy David to whom I can sing the yearning psalms of love? The flute's sweet wailing is because of me, and the lamenting of the lute. I create a tumult among the roses as well as in the hearts of lovers. Always I teach new mysteries, at each instant I repeat new songs of sadness. . . . If I am parted from my dear Rose I am desolate, I cease my singing and tell my secrets to none. . . ."
>
> The Hoopoe replied, "Although the Rose is fair, her beauty is soon gone. One who seeks self-perfection should not become the slave of a love so passing."

In Persian music and literature, and in Baily's Afghan experiment, we see that much of the musicality of bird song lies in its special use of rhythm as much as its organization of pitches and legible melodies. I doubt it is an accident that we hear these sounds as being closer to music than to words. If birds are "emotional creatures with good memories," as Margaret Morse Nice concluded, then they have what it takes to be good musicians. Sotavalta transcribed a music that people had rhapsodized upon for centuries. He found tendencies toward order, not exact memorized syllables always repeated alike. It was enough for him to find real music in the nightingale's song, without needing to know what it is for.

The serious, controlled experiments that were done on nightingale song in the 1980s and 1990s do not focus on the *content* of what is sung, but instead on what can be more easily tested: stimulus and response, singing and countersinging, how birds react to one another and to playback of their own and their neighbors' songs. Dietmar Todt and Henrike Hultsch have studied nightingales in Germany for decades, both in the wild and in captivity. Because of their work and the work of their students, more is known about the singing behavior of these famous birds than of any other species with so complex a song. Their first studies focused on how the birds sing in the wild, while later experiments examined how the birds learn to sing in controlled circumstances.

One of the first aspects of the nightingale's singing behavior that they uncovered is that there are three distinct ways nightingales sing and countersing to each other, beginning late at night and ending by dawn in the first weeks of spring. Adjacent male nightingales tend to sing back and forth to one another, timing the beginning of each song phrase in a precise way. Most males are "inserters"—meaning that they wait about one second after a neighbor's song finishes before starting their own. Songs alternate between one bird and another. Mutual listening occurs, and timing is everything. Then there are "overlappers," who start their song about one second after their neighbor begins, as if to cover up or jam the neighbor's signal. It's some kind of threat or a mask of the first song, cutting into his airtime. Then there are "autonomous singers," who sing and sing according to their own schedule, paying no heed to what any nearby nightingales are doing. The top bird, soloing without peer? Not a care in the world?

When the scientists adjusted the amount of silence between playbacks of stimulus songs, the inserters adjusted the amount of time they waited before beginning to sing. When the stimulus stopped, the birds did not immediately switch back to their usual amount of space between song phrases. Instead, they gradually adjusted the space until they reached their usual speed of delivery. Todt and Hultsch concluded that the birds were truly interacting with the songs they heard, not responding in some automatic manner. The kind of song response seems to be a voluntary choice made by the bird. In a later study they concluded that the way nightingales choose to match song reveals a subtlety not seen in the song sparrow; rapid matching is meant as a kind of keep-away message with intent to warn, while matching after a break of a second or more is a kind of sonic greeting: Hello, here I am, I know that song too.

Each nightingale sings a series of phrases one after another in preferred patterns, much like the wood pewee but with fifty to a hundred different phrase types instead of three. Todt and Hultsch called these recurring groups of phrases *packages:*

> To explain our results on package formation in nightingales, we postulate two kinds of processes: 1. *A parsing process*. We assume that nightingales possess a gating mechanism that passes only a limited number of successively heard song types, and so generates unit-related segmentation of a long sequence of learning stimuli. 2. *A storing process.* We assume that nightingales possess several submemories, each of which can be supplied with data provided "package-wise" by the gating mechanism. These submemories process the received information in parallel and in a way which explains (1) the sequential association observed among song types in the package, and (2) the development of novel song types observed as recombinations of acoustic material stemming from song types in the same package.

This fascinating passage attempts to explain how it is that the bird can listen, learn, decide how to structure a series of phrases it learns, then recall it from memory years after the fact. A musician might call these packages *progressions* or the song *form:* this would suggest a definite level of musical intelligence in the bird, making it sound less like a computer program and more like a musical being.

In the wild, nightingales are thought to learn mostly from their elders, who spend much time feeding the young birds. In Hultsch and Todt's laboratory, birds would not learn songs from playback tapes alone, but required some kind of live model. A human caretaker would do, if the person started feeding the birds when they were young, say, around six days after birth. The most sensitive period of song learning is between two weeks and three months, although nightingales continue to learn throughout the first year, and also refine their repertoires later in life. Imitation seems much more important than improvisation with this species. Each bird learned the 214 master song types off a tape, but only if their caretaker or surrogate tutor was present.

Todt and Hultsch were amazed to discover that young nightingales could hear a song only ten to twenty times and then be able to perfectly reproduce what they had heard. No bird sang a song that it did not hear in the proper tutoring setup. Sometimes they acquired their packages by hearing them on the tutor tape, and deciding that a group of three or four phrases ought to stay together and in order, and sometimes they formed their own packages, which they favored in "song delivery." Then the packages of three to five songs were grouped into "subrepertoires" of three to five packages.

Birds reared together in the laboratory sometimes had an awareness that they shared each other's packages, a bit like the song sparrow matching activity. Hultsch had found the same behavior in wild nightingales a few years earlier. These layers of hierarchies, imposed on one another, resemble the cycles upon cycles imagined by Craig. This behavior suggests some limits in the nightingales' memory: we humans also "chunk" information to recall it more easily. Might the patterns also fulfill a musical purpose?

Since Sotavalta, no nightingale researcher has thought it a worthy subject to analyze the detailed structure of each song type or phrase. Hultsch and Todt do suggest that each motif might finish in such a manner that demands a reply. Maybe the final rattle is like a question mark? If you hear it as music, it's a sound that needs to resolve rather than a final cadence. When the Afghan musicians jam along with Baily's nightingale tape, it sounds like a call and response session that could go on and on for many rounds, with no resolution or release. Nightingales have called to one another for millions of years. Their bouts have no real beginning or end, voicing tendencies that might leave a trace of the bird's own evolution.

The most cutting-edge nightingale science is still at the level of stimulus and response. It's just gotten a bit more specific. A 2002 study by Hultsch and Todt's students, Marc Naguib and Roger Mundry, showed that nightingales respond most intently to whistle songs given in playback. They tend to match the whistles back, often at the same pitch. After playback stops, males respond with a whole slew of whistles. "These findings suggest that whistle songs have a specific signal value and that nightingales treat them as a special song category." What is special about these whistles? We can't say. Nightingale science is quite precise at articulating just how much we still do not know.

Can we be any more certain that nightingales are making music if the song brings pleasure to our ears? "The supreme notes of the nightingale envelop and surround us," wrote Lord Grey of Fallodon in the 1920s. "It is as if we were included and embraced in pervading sound." Yet he is not a complete fan. The song "arrests attention, and compels admiration; it has onset and impact; but it is fitful, broken, and restless. It is a song to listen to, *but not to live with*."

We long for similarities between us and the birds to make us feel more at home in their world. Perhaps animals' perception is farther from our own than we would admit. Sixty years ago Tinbergen noticed a stickleback fish aggressively displaying toward the window of his fish tank. What did he see there? Certainly no red-bellied fish that would indicate the traditional attack posture. No, the fish was striking toward a red mailman's truck far in the distance. Why bring in this story? Nick Thompson, the brown thrasher man, mentions it in his critique of anthropomorphism in ethology, saying that this tale shows that the stickleback has one strange way of reacting to the world. We should not imagine that we share much aesthetic sense with a fish! He really didn't like that truck.

Each animal species lives in its own ethological world. Aesthetics, should we believe they exist in animals, must be part of that. The starling never sings "-nee River." Song sparrows find matching songs to be a sign of aggression. Wood pewees' elegant songs are theirs alone. Why even claim to appreciate bird music for some kind of elusive, eternal essence?

Each living species is unique, but we are still all bound by the same cycles. Birth, experience, love, mating, travel, death. Each one of these phases can be expressed! Raw emotion leads to bird song and also to human art of all kinds. Something needs to be released, and what comes out is often wonderful. Communication and miscommunication both result from listening and playing along. Consider Oscar Wilde's story "The Nightingale and the Rose," where he turns that Persian nightingale tale upside down to imagine a bird trying to interpret human sentiment and performance and getting it all wrong.

A young philosophy student is desperate for a girl who says she will only dance with him if he finds a red rose. But there is none in the garden to be plucked. A nightingale in her nearby nest hears his plight. "Here indeed is the true lover," says the nightingale. "What I sing of, he suffers: what is joy to me, to him is pain." At once the difference between birds and men arises. We suffer in love while the nightingale just enjoys it! (Wilde's singer is a *she,* not a *he,* but literature never exactly matches life.)

There is only one way the nightingale can get the boy a rose—that terrible travail of Persian myth. A tree tells her the method: "If you want a red rose you must build it out of music by moonlight, and stain it with your own heart's blood. You must sing to me with your breast against a thorn." The thorn will pierce the bird and she will bleed into the tree, and a red rose will grow by morning. So love for the bird will strike from joy into pain and then death.

But she's ready to do it, and cries to the student with a song he cannot understand: Be happy, she sings, you will get your rose. "All I ask of you in return is that you will be a true lover, for Love is wiser than Philosophy." The student looks up, not comprehending, and only whispers, "Sing me one last song. I shall feel very lonely when you are gone." And then remarkably, he starts to *analyze* the music he hears: "She has form—that cannot be denied to her; but has she got feeling? I am afraid not. In fact, she is like most artists; she is all style, without any sincerity." If he only knew why she has begun to sing, and where it will end! All for him! "She thinks merely of music, and everybody knows that the arts are selfish. Still, it must be admitted that she has some beautiful notes in her voice. What a pity it is that they do not mean anything, or do any practical good." The boy remains a philosopher, trained better as a critic than anything else.

He goes to bed to dream of love, not listening closely enough to the bird to grasp what she was doing for him. In the morning the nightingale lies on the ground, dead, but on the very top of the tree stands a magnificent red rose, "petal following petal, as song followed song."

What luck, cries the student, and plucks the great flower. He takes the proud flower to his girl, but she just sloughs it off. It won't go with her dress, and another boy has already bought her some gemstones. "Everybody knows jewels cost far more than flowers." The student tosses the rose into the street, and a cart runs over it. "What a silly thing Love is," he decides. "It is not half as useful as Logic." It always makes us believe things that are not true.

The nightingale spilled all of her blood to use song to make a flower, which no one cares for after it fails. The bird and the human never understand one another. That beautiful suicidal music changes nothing at all.

The basic criticism of the romantics' love of nature is that they listened to birds and heard only themselves. If we are sad, the nightingale sings a sad song, and if we are happy, the same music is all about joy. Wilde reverses this "pathetic fallacy" and has the nightingale suffering because she imagines the young boy is consumed with passion, while in fact he is a lover of logic more than anything else. He, in a similar blunder, hears design in the bird's fatal song but no great wonder or force. He wants the flower but hears no connection between blossom and bird. Because the splendid rose gets him nothing in the end, he throws it out and goes back to his books, having learned nothing of love, nature, or life.

What will it take for us to learn what comprises the song world of birds? We need reason, passion, and diligence. Here are a few people who have taken time and effort to decode glimmers of meaning out of the surges and patterns of the sounds of birds. They have listened and waited, imagined and described. Music, science, poetry, practice, and theory intensify our awareness of nature's music without reducing the lingering wonder. If all the information doesn't bog you down, you may emerge from all the details with more ability to pay attention when you hear a bird sing.

It is a small step from playing a bird back his own song to playing him ours instead. In the 1920s, the British cellist Beatrice Harrison moved to the Surrey countryside and began practicing outdoors in spring. Nightingales began to join along with her, and she heard them matching her arpeggios with carefully timed trills. After getting used to her they would burst into song whenever she began to play. In 1924 she managed to convince Lord Reith, director general of the BBC, that a performance of cello together with wild nightingales in her garden would be the perfect subject for the world's first outdoor radio broadcast. Reith was initially hesitant: Surely this would be too frivolous a use of our latest technology? What if the birds refuse to cooperate when we're all set to go?

It took two truckloads of equipment and a bevy of engineers a whole day to set up what could today be arranged in minutes. The microphone was placed close to the nightingale's usual singing post. Harrison dressed in finery as if for a London premiere, though she sat with her cello in a muddy ditch next to the bird's bush so that the one microphone could pick up both of them. She started with "Danny Boy" and parts of Elgar's cello concerto, which had been written especially for her. No sound came from the bird. Donkeys honked in the distance, rabbits chewed at the cables, but no bird could be heard. This went on for more than an hour. Things didn't look promising.

Suddenly, just after 10:45 P.M., fifteen minutes before the broadcast was set to end, the nightingale began to sing, along with Dvorak's "Songs My Mother Taught Me." If Hultsch and Todt were listening, they would definitely hear song overlapping here. Was the bird trying to "jam" the cello message? Most of us would hear something more mutual—a mixture of bird and Beatrice, an attempt to blend. Doth the pathetic fallacy rear its ugly head—naïve anthropomorphism, or some moonstruck wish to hear music where there is nothing but practical noise?

I doubt many of the more than one million listeners who tuned into this broadcast were so skeptical. Never before had a bird's song or any other sound from the wild been sent out over the airwaves. The program was heard as far away as Paris, Barcelona, and Budapest, and many who had read the famous nightingale tales now heard one on radio for the first time. Harrison received fifty thousand letters of appreciation. After this late-night triumph she became one of the most sought-after cellists of her time.

The cello-nightingale duet was repeated live each year on the BBC for twelve years, and afterward the birds alone were broadcast until 1942, when the recording engineer making the show heard a strange, unmistakable droning sound that turned out to be the beginnings of the "Thousand Bomber" raid heading via Dover to Mannheim. He quickly shut off the sound, having the sense not to broadcast it during wartime. The recording was preserved, and you can hear it today, this strange soundscape of menacing bombers and incessant nightingales, singing as they always do, even in the midst of human destruction and the violence that comes with civilization. Even airplanes could not silence the nightingale. Here is a bird who cares nothing for the whims of men or the great noises we produce. Does he know his place extends far beyond the disasters of history?

After the war, science moved away from such musical analogies and interactions to focus on how birds are able to learn such intricate sounds. None of our primate relatives manage anything like this feat at all. In addition to a love of music, we share vocal learning only with a small number of bird species and some dolphins and whales. Birds are smaller, more common, and easier to cut up. In recent decades science has turned away from descriptive structure to peer directly into bird brains. It has found something more astonishing and revolutionary than anything we have seen or heard thus far.