What's That Bird Song? • Ask the Gizmo!

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"Why can't I hold up my mobile device and have it identify the bird I'm hearing?" As "Tools of the Trade" columnist, I am asked no question more frequently than that one.

Perhaps it's because identifying bird songs and calls is challenging, indeed frustrating at times. Or perhaps many birders have decided their ear is "no good." Maybe we no longer have the patience to wait until a skulking Kentucky Warbler (or surprise—an Ovenbird!) obliges us with a confirming view. And I know I'd love to have definitive answers to my guesses on Pine Warbler vs. Chipping Sparrow.

When faced with an unknown vocalization, the problem is where to start. Consider *Birding* Editor Ted Floyd's "Easy Hard Photo Quiz" on The ABA Blog, showing 10 spectrograms of birds recorded within a few blocks of his suburban home <tinyurl.com/ABABlog1001>. Several respondents admitted they pulled out their old Golden Guide (the first and still the only major paper guide with spectrograms) and flipped through every page looking for a match. That's not much different from the beginning birder who flips field guide pages, from Bell's Vireo to Lesser Goldfinch, trying to identify the small yellow bird at their feeder. Frustrating.

Now imagine a mobile device recording a bird song or call in the field, matching it with a stored database of bird sounds, and displaying the identified bird. Wow! If that's not possible, how about providing a set of likely choices? Then at least we'd have a short list of audio tracks to compare for a final decision.

There is a lot of technical and theoretical activity on what is called *automatic bird sound recognition*, involving everything from time-delay neural networks to hidden Markov models. But, as Nate Swick asked in The ABA Blog in 2011, is "Digital Bird Song Identification a Reality?" <tinyurl.com/ABABlog1019>.

The answer is "not quite yet." It's likely a matter of time, but, meanwhile, where are we now? Let's look at four very different tools for recognizing bird vocalizations: the Dick software, The Song Sleuth device, the new app BirdSongId, and the forthcoming app WeBIRD.

This **Kentucky Warbler** is giving us a good view. But the species is notorious for staying out of sight while singing. When a bird can't be seen, a computer-confirmed sound match would be a big help. Might the day come when "heard-only" birds are routinely identified not by our ears and brains, but rather by apps? This review takes a look at the somewhat bumpy but nevertheless promising development of software for automatically identifying birds by their vocalizations. *Photo by © Jacob S. Spendelow.*

Dickcissels in the Night

If you've ever listened at night during spring or fall, you've likely heard the *pwee* of Swainson's Thrushes, the *tseep* of overhead sparrows and warblers, or maybe even the undeniably flatulent *djjjt* of a Dickcissel.

Some of the earliest work in automatic song recognition focused on the nighttime flight calls of Eastern and Midwestern migrants. Given the overwhelming number of species and their vocalizations, it made sense to narrow the task to simple, monosyllabic nocturnal flight calls (NFCs).

Take the Dickcissel, a grassland bird of conservation interest that has a distinctive flight call, often given at night during migration. One of the earliest successful automatic recognition algorithms was the single-species Dick, launched in 1998 by Bill Evans (co-producer with Michael O'Brien of the instructional DVD, *Flight Calls of Migratory Birds*).

Because the Dickcissel's call is relatively distinct from other avian night flight calls, Dick is at least 85% accurate, only occasionally fooled by buntings, Blue Grosbeak, or a particular pre-dawn Purple Martin call. The Dick software is still in use today, has made important conserva-

tion contributions (see Conservation-Connection), and is available as a free download <oldbird.org>.

For those of you familiar with Evans's Thrush and Tseep freeware (also developed in 1998 and still widely in use), those two algorithms are officially *call detection software*. Thrush takes a recording and automatically picks out the class of call notes for Swainson's, Gray-cheeked, and Bicknell's thrushes. Tseep is similar, but gleans out the soundtrack snippets for the *tseep* flight calls given by warblers and sparrows. In both cases, the intent is not identification to species (which is later done by humans), but to remove some of the tedious work by automatically culling through hours of recordings. Dick is automatic recognition software because, almost by quirk of the Dickcissel's highly distinctive flight call, it identifies to a single species.

A lot has changed since 2006, when The Song Sleuth was reviewed in the March/April installment of *Birding's* "Tools of the Trade." *Photo by © Derek Lovitch.*

Despite the time-proven use and success of Dick, Thrush, and Tseep, most daytime in-the-field birders are hoping for more. These algorithms are intended to help with bulk sound analysis. They were never intended as all-purpose in-the-field identification software. For that we need another product, geared to consumers wanting to identify the daytime songs of common birds.

The Song Sleuth

Remember The Song Sleuth, marketed as an "audio birdsong detective"? Maybe you still own one, stored next to your VHS tapes. (See Derek Lovitch's review, "The Song Sleuth," *Birding*, March/April 2006, pp. 72–76.)

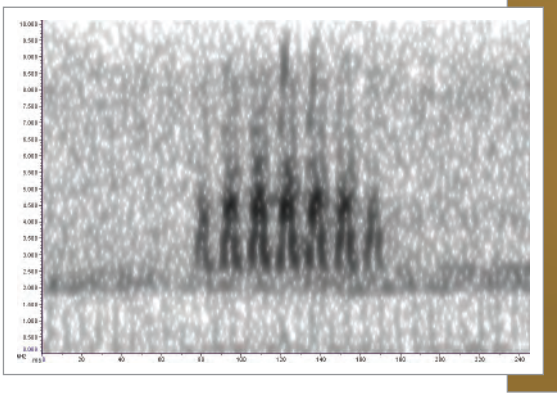
The Song Sleuth was one of the first attempts to digitally identify birdsong. Its creators, Wildlife Acoustics, claimed an 80% success rate, providing the three most-likely choices from among its stored database of 60 species. Lovitch tested the device and found it did help narrow the choices, but demanded a noise-free single-bird recording from within 50 feet. It was not ready for prime time, as even a species with a characteristic long-winded song, the Winter Wren, stumped the sleuth.

Dating from 2006 (which must seem like 1980 from an iPhone perspective), The Song Sleuth weighed nearly two *pounds* and cost several hundred dollars. Ultimately, Wildlife Acoustics shifted its attention to more profitable software for professional ecologists, and The Sound Sleuth was pulled from the consumer market.

BirdSongId

A new app, BirdSongId Automatic Recognition and Reference, has recently entered the name-that-birdsong arena. Originally developed for birds of the British Isles (£2.99 for iPhone, iPod, and iPad), a regional version for North America, BirdSongId USA (North East), was released in June 2013 ($3.99, also for iOS) <isoperla.co.uk>.

BirdSongId USA (North East) includes 26 auto-recognition species, ranging from House Sparrow as the most ordinary to Common Redpoll as the most uncommon. Subsequent upgrades likely will add species. The app also includes a "Manual ID" mode, where the user selects pitch (high or low), melodious (yes or no), regularity (regular or variable), volume

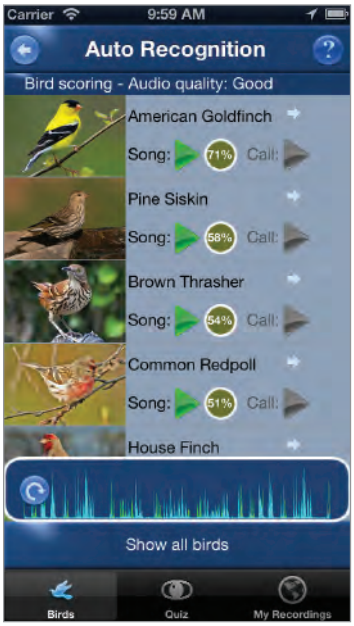


An adult male **Dickcissel** in breeding plumage, all teed up in plain view, is unmistakable. But many Dickcissels are detected and identified as they fly over, invisible, in the night sky. The Dickcissel's buzzy flight call is distinctive, and our ears hear this distinctiveness. We can also "see" this distinctiveness when we examine a sound spectrogram of the species' flight call. A computer "sees" it, too, and sound-recognition software has proved useful for detecting the flight calls of Dickcissels. *Photo by © Matthew Studebaker. Sound spectrogram by © Bill Evans.*

(quiet, medium, or loud), and length (short, medium, or long); the result is a short list of matches from among 100 species.

With BirdSongId, you record a 30-second in-app clip, touch "Automatic Recognition," and wait a couple of seconds. The app displays a list of species with each bird's percent likelihood of a match. By limiting the number of species, the app can store its own sound library, so you don't need an internet connection.

At this point it's not fair to do a full review of BirdSongId, because its help file opens with the disclaimer, "Automatic Recognition in the early stages of development. Please be gentle." So I will. I tested it in Massachusetts on common birds like Blue Jays, Carolina Wrens, House Sparrows, and Tufted Titmouses. It was easy to use and sprightly, and got the right bird in the top 10 contenders (of 26 species), usually in the top five. The developers hope to get the correct bird into the top three choices with at least an 85% hit rate.



BirdSongId displays a list of probable matches to your iPhone recording, providing guidance, not a foolproof answer, to browse and re-listen to a short list of candidates.

The biggest challenge was on my end. The app is preset to 30 seconds of recording for its input, but I often had difficulty getting an acceptable clip of a single bird vocalization with limited background noise. Don't expect too much if the app warns you that your recording is poor or fair.

It's not yet ideal birdsong recognition, but this app is worth watching for regional beginning birders hoping for some clues to limit playback search. The developers intend to add more species and more vocalizations. But at this point, BirdSongId's success stems from focusing on a limited number of species in a narrow geography. Having fewer species allows the song library to be stored inside the app for offline use and, most important, tailors its match-making to subtle regional dialects. For now, with a focus on the familiar vocalizations of expected species, the app's appeal will be limited chiefly to beginner ear-birders.

WeBIRD

WeBIRD, the Wisconsin Electronic Bird Identification Resource Database, has received a lot of attention over the past couple of years. This project hopes to identify bird vocalizations automatically using a smartphone app.

WeBIRD has undertaken the *big* project: to identify songs and calls of all North American birds. Because this requires a huge comparison database, WeBIRD transmits your bird recording to a remote computer where the matching songs reside and the comparisons are done (which takes a few minutes). It's too much data and too computationally taxing for your iPhone. If you are offline in the field, you can save the recording and send the query later.

Your in-field recording is matched using seven acoustical measurements, such as frequency, time, and intensity, to produce a similarity score. The algorithm picks the species with the best score.

Initially targeted for a 2012 release, WeBIRD remains in development. The latest report from project leader Prof. Mark Berres at the University of Wisconsin is that WeBIRD performed well last spring on resident and local birds near Madison. But then the migrants arrived, and WeBIRD couldn't recognize these non-resident visitors.

The problem lies in the differences within species, across regions, and even across individuals. A Tufted Titmouse sings differently in Wisconsin than in Maine. Birders with experience and a keen ear can overcome this variation, sometimes even recognizing individuals, for example, male Baltimore Orioles, by their intonation, modulation, and so on. At this time, all these variations flummox a computer—and the comparison library required must be too large.

ConservationConnection

Many of the products featured in "Tools of the Trade" are unsung advocates for bird conservation, contributing to organizations, volunteering their time, or donating goods. This new sidebar highlights how purchasing each birding tool benefits the birds.

Bill Evans, creator of the freeware Dick, founded the non-profit group Old Bird, Inc., which promotes education about and awareness of the nocturnal migration of birds and the use of technology to prevent bird collisions with human-made structures <oldbird.org>.

Isoperla, developer of BirdSongId, donates some of its proceeds to The Royal Society for the Protection of Birds <rspb.org.uk>. As Isoperla expands into the ABA Area, the company intends to contribute to North American bird conservation projects.

WeBIRD is a non-funded project using donated faculty and student time, motivated by the premise that helping citizens identify birds is the first step toward advocating bird conservation. WeBIRD hopes to "connect people to birds through mobile technology." WeBIRD's website hasn't been launched yet, but a basic introduction is provided via an online video <tinyurl.com/WeBIRD-intro>.

Here WeBIRD identifies the audio as that of a Blue Jay, as seen by the statistical results showing %ID=94.2. The WeBIRD project has not yet released a consumer-oriented birdsong recognition app.

Photo by © Matthew Studebaker.

So the next step involves building up WeBIRD's database with songs from non-resident species. A project of this scope can only succeed with a much broader selection than the Cornell Lab of Ornithology's Macaulay Library recordings, which form WeBIRD's current database and may only have one or two exemplars of a region or song. WeBIRD has now shifted to the *collecting* of bird sounds, in the hope that the use of the app will create crowd-sourced, location-aware recordings. In other words, when released, the app's performance will improve the more we all use it, as our recording and identification attempts fuel a richer database of sounds.

With the need to develop a crowd-sourced database (and a two- to three-year patent process), don't expect a fully functional WeBIRD—one that can identify all bird songs and calls in North America—to show up in the iTunes store next month, and probably not even next year.

Northern Mockingbird 92% Certain

Most birders are probably asking, "What's the big deal?" Shazam or SoundHound can analyze a clip of music and tell you the artist, title, and album. Nayio claimed to match your off-tune humming to recall a song. If you telephone an airline, you can say, "New reservation," and voice-recognition software understands your words. Why can't a device simply spew back: "Northern Mockingbird 92% certain"?

As developers continue their battle on the front lines of automatic birdsong recognition, they face several challenges.

First, the bird vocalization problem is plain-old hard. Take human speech recognition as an analogy. It's relatively "easy" to program a computer to recognize *words*, but nearly impossible to develop a single, non-comparative algorithm to recognize an individual's *voice*. Yet presumably you immediately recognize your spouse's voice on the telephone. Similarly with bird vocalizations: If you record a bird song and play it over the telephone to an experienced ear-birder, he or she can immediately tell you, "Oh, that's a Hooded Warbler." But for a computer, not so easy...

Second, we're only beginning to fathom the extent of regional, subspecies, and even individual variation in bird songs and calls. White-throated Sparrows sing differently across their range. And don't even think about that hatch-year male Song Sparrow, squeaking out a practice song, sounding like a Marsh Wren with a cattail tickle in its throat. And then there are the mimics! What to do with a Northern Mockingbird imitating a White-breasted Nuthatch, or a Blue Jay that sounds just like a local Red-shouldered Hawk?

Third, getting an acceptable recording is no easy feat. The problem isn't simply recording quality, although a good microphone helps. (See my article, "Pocket Bird Recording," *Birding*, July/August 2013, pp. 52–55.) These algorithms are created for in-field use, not optimized for stock recordings, and must have sufficiently long clips of noise-free, representative song. I was surprised, even in a quiet suburban setting, how difficult it was to get an acceptable 30-second recording for BirdSongId. The Blue Jay posse interrupted each other, spoiling my clip with the overlap of multiple vocalizations. Even the Carolina Wren, belting out its song, produced an audio recording with a quality warning by BirdSongId.

Automatically identify that bird sound? We're not there yet, but it's probably just a matter of time. Until an app comes along—which it surely will—that distinguishes a Pine Warbler from a Chipping Sparrow, I'll enjoy practicing the ancient art of identifying bird songs and calls. Just as wood carving, oil painting, and instrumental music have flourished despite the invention of DEWALT power sanders, Corel Painter, and Apple GarageBand, so we will continue to enjoy and get better at ear-birding.