

DISPATCHES

Animal Culture: How a New Birdsong Went Viral

David M. Logue^{1,2*} and Jean-Baptiste Leca¹

¹ Department of Psychology, University of Lethbridge, Alberta, Canada

² Department of Biology, University of Puerto Rico, Mayagüez, Puerto Rico, USA

*E-Mail: david.logue@uleth.ca

A new white-throated sparrow song has overtaken most of Canada in less than 20 years. The explanation for this remarkably fast spread may lie in the southern migratory grounds, where populations from across Canada converge each winter.

Accepted in *Current Biology* (July 15, 2020)

It was the summer of 1960. Teenage America was doing The Twist, Rome was hosting the Olympics and Peter Marler and Miwako Tamura were hauling a massive reel-to-reel tape recorder around Northern California, documenting songs of white-crowned sparrows (*Zonotrichia leucophrys*). It is easy to imagine that their recordings from Berkeley seemed unremarkable at the time, since all of the birds sang the same kind of song. However, when Marler and Tamura lugged their recorder three kilometers northeast to Inspiration Point, they made a discovery that would alter the trajectory of cultural evolution research. There too, they collected a “very homogenous sample” of songs, but these songs were distinct from the Berkeley song [1]. The white-crowned sparrow populations in Berkeley and Inspiration Point each had their own 'dialect'. Further study revealed a patchwork of temporally stable, clearly delineated dialect regions, each with its own characteristic song [2-4]. Research on birdsong dialects exploded as biologists struggled to explain how dialects emerged, and how they could remain stable over generations [5]. Sixty years and dozens of papers into the story of song dialects, a study by Ken Otter, Scott Ramsay and colleagues [6] in this issue of *Current Biology* introduces an unexpected twist: new dialects can grow very big, very fast.

The song of white throated sparrows (*Zonotrichia albicollis*; Figure 1) sounds like a whistled version of “Oh, Canada” that goes off the rails after the first note. Ken Otter’s team noticed that over the course of the late twentieth century, a novel 'doublet-ending' song had gradually replaced the previously dominant 'triplet-ending' song in male white-throated sparrows in western Canada. The novel song type does not seem to convey any fitness advantage to birds that sing it, suggesting that its adoption is not under positive selection [7,8]. For their latest study, Otter and colleagues [6] used audio archives from both professionals and citizen scientists to track the distribution of the novel song variant across North America. Their analysis of recordings from a whopping 1785 birds shows how the novel song variant swept over the continent like a wave in just a couple of decades, almost entirely replacing the ancestral song along the way [6]. Their discovery is not the first report of a rapidly changing song variant [9,10], but it is remarkable for the speed and geographic scale of the spread, and the nearly complete replacement of the old song variant by the new one. Cultural evolution is usually the best explanation for the rapid propagation of learned, arbitrary, non-functional behaviors in social animals [11]. Yet, these new findings are difficult to reconcile with cultural evolutionary theory: how could a culturally transmitted song advance so rapidly, when young males typically settle close to their natal territories?

Under low-dispersal conditions, cultural evolutionary theory predicts three possible outcomes after a novel cultural trait arises: gradual and directional spread of the trait due to socially-influenced adoption; random change in the trait due to copying errors; or stasis, as juvenile immigrant males settling in non-natal populations converge on the predominant local variant [5]. None of these canonical cultural evolutionary processes can explain the observed rapid spread of the doublet-ending song. Otter and colleagues [6] offer an elegant resolution to this apparent paradox.

Like most northern temperate songbirds, white-throated sparrows migrate south for the winter. Otter’s team suspected that migration held the key to the novel song type’s success, so they attached light-logging geolocators to breeding sparrows in British Columbia. The next year, they recaptured a few of those birds and analyzed the pattern of light and dark recorded by their

geolocators to estimate where they had spent the winter. Most of the British Columbian white-throated sparrows wintered in the southern United States, which happens to be where central Canadian white-throated sparrows spend the winter [12]. Could the novel song have spread from western Canada to central Canada via — Arkansas?

This ‘winter transmission’ hypothesis is only plausible if birds sing and learn songs on their shared wintering grounds. The citizen science data show that white-throated sparrows do sing in the winter [6], and there is circumstantial evidence that the closely related white-crowned sparrow learns songs from other dialect regions in the winter [13]. Although the study does not provide direct evidence of inter-population song transmission on white-throated sparrow wintering grounds, winter transmission is the most plausible explanation for the rapid spread of the doublet-ending song.

The discovery that winter transmission may accelerate cultural evolution shines a spotlight on the little-known phenomenon of winter song in migratory birds. Traditionally, scientific research on birdsong has focused on loud, daytime, breeding-season song in north-temperate males. The last 20 years have seen a new and diverse cohort of birdsong scientists explore non-canonical birdsong systems like soft song [14], nocturnal song [15], female song [16], and song in tropical and austral species [17]. The provocative suggestion that winter song promotes rapid cultural evolution positions this historically neglected phenomenon as one of the next frontiers in birdsong research.

More broadly, the idea that cultural transmission in shared migratory areas can trigger rapid, cross-population exchanges of learned vocal signals is a testable hypothesis that elegantly links ecology to cultural evolution. Migration is common in several vocally learning taxa, including whales and dolphins, bats, songbirds and humans. Large-scale movements by humans [18], whales [19,20] and now birds [6] have been shown to facilitate cultural exchange between populations. Recent advances in citizen science, remote sensing, and geographical information systems open the potential for broad-scale analyses of migration’s effects on the bio-cultural evolution of communication

The rapid and complete turnover of a culturally transmitted trait documented by Otter and colleagues [6] parallels a previous finding in Australian humpback whales. The whale study shows how a song from an Indian Ocean population completely replaced the Pacific Ocean population’s traditional song in under two years. Remarkably, it took only a few ‘foreign’ singers to facilitate this revolution [19,20]. These two distantly related species — a songbird and a whale — present a similar pattern in which songs that typically evolve gradually and locally undergo rapid and widespread evolution in response to contact between two populations with distinct cultures.

Winter transmission may explain the speed of the doublet-ending song’s spread, but it cannot explain the totality of its take-over. Why did the doublet-ending song lay waste to the previously popular triplet-ending song? Why don’t the two song types co-exist all across Canada? At this point, we can only speculate. Perhaps birds have an innate bias to preferentially adopt the doublet-ending novel song, either because of its particular acoustic structure or because of its novelty. Alternatively, it is possible that birds follow a rule to learn preferentially from a

certain kind of tutor (e.g., socially dominant), and the western birds tended to be the right kind. If birds followed the rule to copy songs that are increasing in frequency, a few initial adoptions might have been enough to kick-start runaway cultural evolution. While the mechanisms responsible for the doublet-ending song's hegemony will take time to unravel, the study's main findings are poised to have an immediate impact on the field of cultural evolution.

The new study on white-throated sparrow songs proves that a birdsong dialect can spread rapidly over long distances and implicates wintering ground song transmission as a driver of cultural evolution. As Marler and Tamura were hauling their recorder around Berkeley recording birds one-by-one, they could scarcely have imagined downloading hundreds of indexed digital recordings with the click of a mouse, much less spying on their birds' migratory destinations with geolocators. With their new study, Otter and colleagues [6] apply the logic and curiosity of these cultural evolution pioneers to data that could only be acquired with contemporary technology. Their findings prove that after all these years, the story of birdsong dialects still has secrets to share.

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Figures

Figure 1. A white-throated sparrow.



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