

Human language and birdsong both acquired through stepwise imitation

30 August 2013



Figure 1: Bengalese finches (pictured), like zebra finches and human babies, learn new vocalizations through imitation in a step-by-step manner. Credit: 2013 Kenta Suzuki, RIKEN Brain Science Institute

Songbirds and humans both learn to vocalize by imitation and produce their respective sounds in much the same way, by arranging syllables into sequences. Very little is known, however, about how this ability arises during development. Kazuo Okanoya from the Laboratory for Bilingualism at the RIKEN Brain Science Institute, as part of collaboration with a research team from the City University of New York, have now shown that humans and songbirds also acquire their vocalization skills in the same way—by learning new combinations of syllables in a stepwise manner.

The research team, led by Ofer Tchernichovski and Dina Lipkind from the City University of New York, first compared the development of sound combinations in [zebra finches](#) (Fig. 1) through a series of experiments involving song training using slightly altered songs. In these experiments, the subject would hear and learn one song, then the original song would be altered slightly so that the

birds would have to rearrange the order of syllables in the song or insert an entirely new syllable. The researchers then examined natural song development in Bengalese finches (Fig. 1) and babbling development in humans.

Of the 17 [zebra finches](#) tested, 8 learned the new song successfully, on average after 17 days of training. The birds stopped singing the original song either at the same time as, or a few days before, starting to sing the new song.

Analysis of the songs revealed that the transition between the original and new songs occurred gradually, with new pairs of syllables being added in a series of intermediate steps. Birds would sing the intermediate songs several thousands of times, with an average gap of about six days between the appearance of each syllable change. Once the transition was complete, the birds suddenly switched to the new song and never sang the original song again. Birds that failed to completely adopt the new song learned in the same way, but ceased the transition to the new song prematurely, resulting in a song somewhere between the original song and new song.

The researchers also found that Bengalese finches learn to sing their more complex songs in a similar manner and that the 'babbling' of human babies develops in the same way too, with newly learned syllables first being repeated and then connected to other new [syllables](#) in gradual steps.

"We can now study neural mechanisms for sequencing in birds and apply the results to understand human speech production," says Okanoya. "This might help to understand and provide cures for certain speech disorders."

More information: Lipkind, D., et al. Stepwise acquisition of vocal combinatorial capacity in songbirds and human infants, *Nature* 498, 104–108 (2013). [dx.doi.org/10.1038/nature12173](https://doi.org/10.1038/nature12173)

Provided by RIKEN

APA citation: Human language and birdsong both acquired through stepwise imitation (2013, August 30) retrieved 21 June 2021 from <https://phys.org/news/2013-08-human-language-birdsong-stepwise-imitation.html>

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