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# Songbirds can learn flexible contextual control over syllable sequencing

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## Abstract

The flexible control of sequential behavior is a fundamental aspect of speech, enabling endless reordering of a limited set of learned vocal elements (syllables or words). Songbirds are phylogenetically distant from humans but share both the capacity for vocal learning and neural circuitry for vocal control that includes direct pallial-brainstem projections. Based on these similarities, we hypothesized that songbirds might likewise be able to learn flexible, moment-by-moment control over vocalizations. Here, we demonstrate that Bengalese finches (*Lonchura striata domestica*), which sing variable syllable sequences, can learn to rapidly modify the probability of specific sequences (e.g. 'ab-c' versus 'ab-d') in response to arbitrary visual cues. Moreover, once learned, this modulation of sequencing occurs immediately following changes in contextual cues and persists without external reinforcement. Our findings reveal a capacity in songbirds for learned contextual control over syllable sequencing that parallels human cognitive control over syllable sequencing in speech.