

Nature and Nurture in Development: A Case Study on Swamp Sparrows (*Melospiza georgiana*)

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Male swamp sparrows are more attractive to females and succeed more in competition with other males if they sing faster songs. Previous research has demonstrated that there are both learned and unlearned (inherited) aspects to swamp sparrow song: birds must hear and learn particular notes as juveniles in order to sing properly as adults, but the rate at which birds sing the songs is not learned. Instead, each bird sings its song as rapidly and consistently as possible, according to its individual abilities. Currently we are monitoring the way young swamp sparrows practice singing in their first year in an attempt to find out how the learned and inherited aspects of their song interact during development.

Questions

- If tutor songs are experimentally slowed, do birds imitate the slow song, or else develop a faster song according to unlearned biases?
- How does the developmental trajectory of learned vs. unlearned song features differ? Which aspects develop more quickly? Do inherited vs. learned features crystallize at different times?
- Do birds increase in accuracy or consistency of song structure over development?



Methods

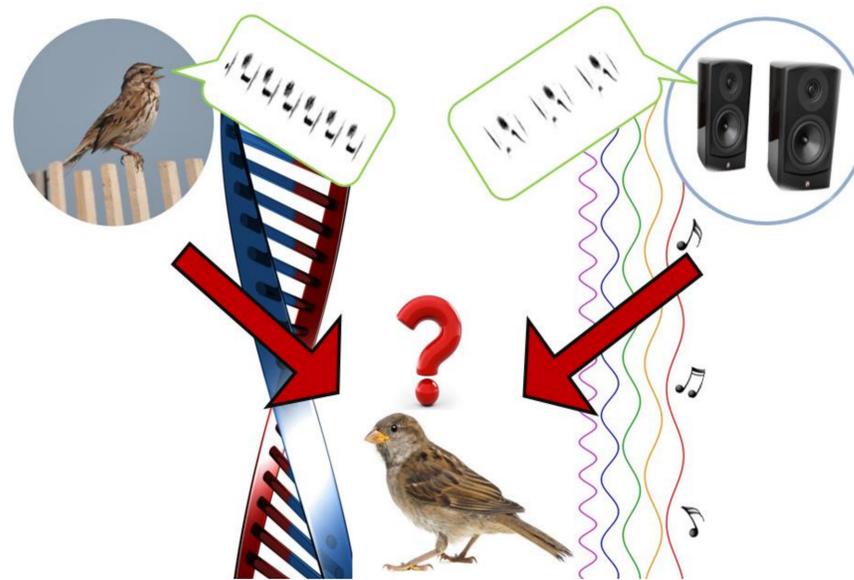


Figure 1. Young swamp sparrows were hand-reared in the laboratory and tutored with recordings of songs, many of which were manipulated digitally to be different in trill rate from those their fathers sang in the wild.

Data Collected

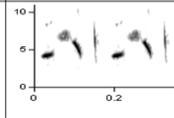
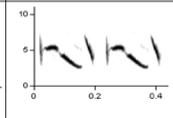
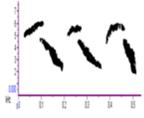
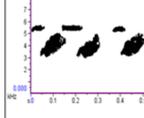
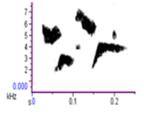
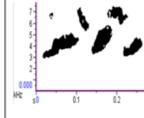
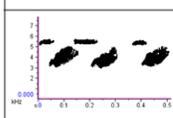
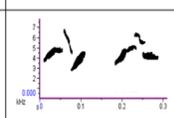
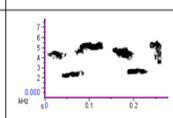
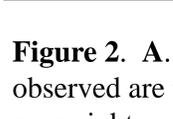
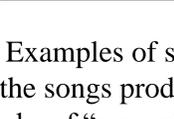
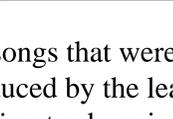
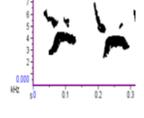
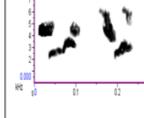
A. Song Learning			B. Vocal Development		
Songs Played to the Birds (Frequency vs. Time)			Beginning	Middle	End
Song 1	Song 2	Song 3	Song B		
					
Songs Observed (Audacity) Frequency vs. Time			Song E		
Song 1	Song 2	Song 3			
			Song G		
					

Figure 2. A. Examples of songs that were played to the juvenile swamp sparrow. Songs observed are the songs produced by the learning birds. B. Change in syllable structure over eight weeks of “sensorimotor learning” (vocal development) in the spring.

Results

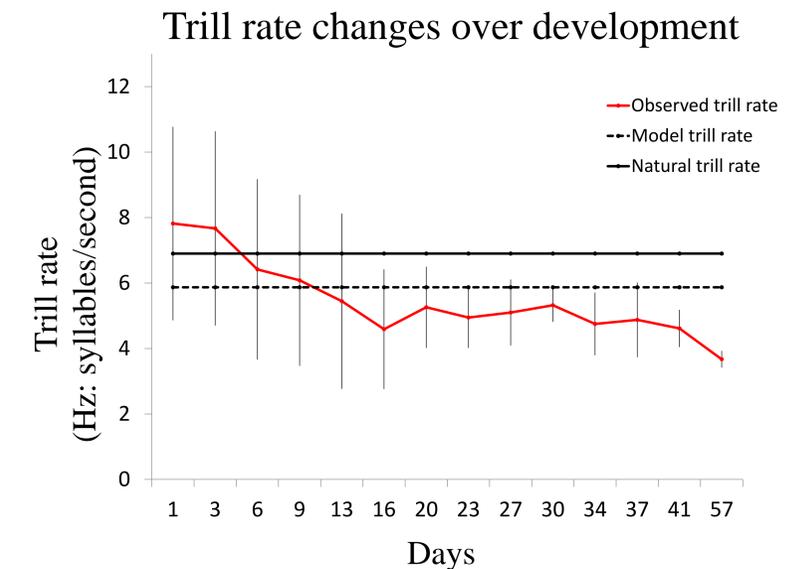


Figure 3. Both the mean and the variance of song trill rate decreased during vocal development. The bird was tutored on a 5.9 Hz song (Model), which was digitally manipulated from a 6.9 Hz song (Natural). The final crystallized (Observed) song had a trill rate of 3.9 Hz.

Conclusions

- The young swamp sparrow initially sang at a very high but variable trill rate, and had inconsistent song structure.
- Trill rate became more uniform (less variable) over development, and decreased to a very low level.

Hypothesis: Unlearned features manifest early in development, but can be modified subsequently by learning. For instance, in order to increase song accuracy, some birds might have to sacrifice trill rate.