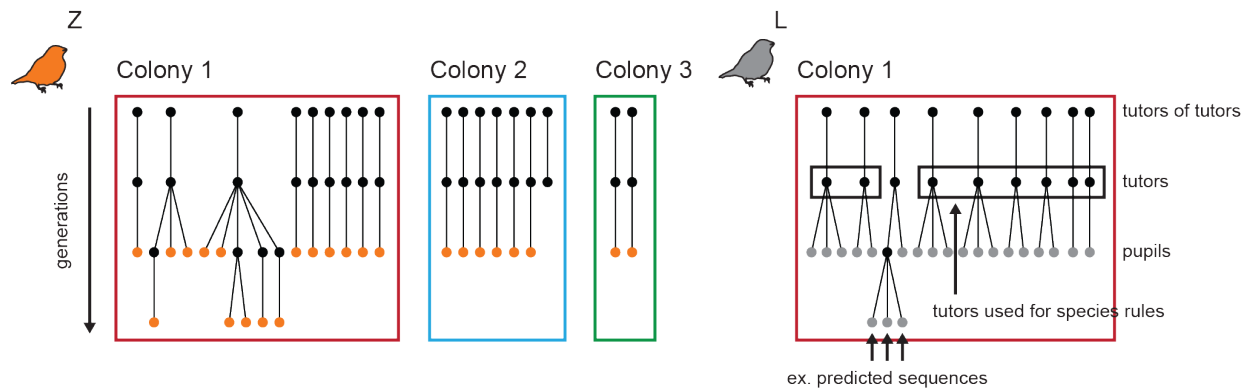
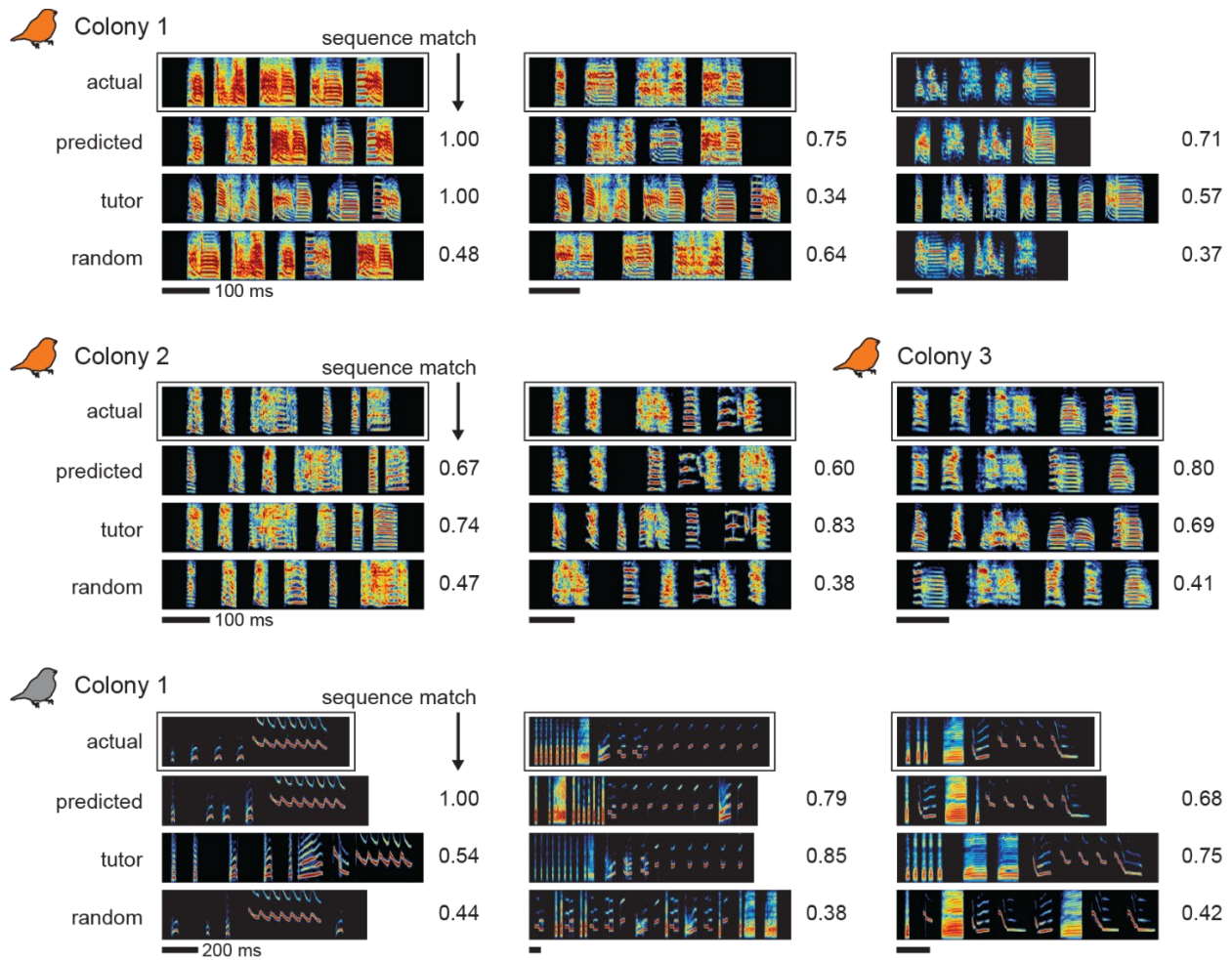




Supplementary Figure S1. Family lineage of each bird included in the study. Each point represents an individual, and lines connect individuals along a lineage (flowing downward, from tutor to pupil). Black points are tutor birds used to train the models (2nd and 3rd rows only), and colored points (orange/gray) are pupil birds used to test the models. Colored boxes surround birds of each colony: Colony 1 (red; Columbia University), Colony 2 (blue; Tufts University) and Colony 3 (green; University of California, San Francisco). An example design for the model training and prediction procedure is shown on the L tree on the right. Arrows at the bottom indicate pupils' song sequences that were predicted. The model for those individuals was trained using only the songs of tutor birds outlined in black boxes. Any birds' songs along the pupil's lineage were excluded from the species rules model. The closest relatedness that any pupil could have to an included tutor is 0.0625, and the closest any two included tutors could be related is 0.125. The top row (tutors of tutors) is shown but their songs were not analyzed.



Supplementary Figure S2. Additional example spectrograms of pupils' actual motifs, species rules predictions, tutors' motifs, and random arrangements of pupils' syllables. The top row of examples are spectrograms of songs of Colony 1 zebra finches, the middle row shows songs of Colony 2 (middle and middle-left) and Colony 3 (middle-right) zebra finches, and the bottom row shows songs of Colony 1 long-tailed finches. Actual motifs are surrounded by black boxes, and sequence match scores are to the right of each spectrogram.