BEHAVIORAL MEASUREMENTS OF A TEMPORALLY PRECISE MOTOR CODE FOR BIRDSONG

(Supplementary Materials)

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Summary

The main manuscript focuses on pairwise relationships and the influences on "identity-specific" variability that is preserved across motifs. This supplementary material details measurements of the total amount of note length variability and the influence of note spectral type. We had previously found no influence of spectral type on elasticity among song syllables (Glaze & Troyer, 2006). However, many syllables are composed of multiple notes having distinct spectral profiles; this was a severe limitation on the resolution of that analysis. See the main manuscript for definitions of note spectral types.

Elasticity

We first analyzed the influence of note type on elasticity, the ability to stretch and compress with tempo changes. (Fig. 1). We found a significantly different distribution in one group, "intro-like", short, noisy sweeps which resemble introductory notes and are most often the first note produced in a motif. Mean elasticity among intro-like notes was 2.05 ± 0.39, among others, 0.96 ± 0.06 (WSM, $p < 0.005$).

Importantly, we had also previously found that the first syllables of motifs are also significantly more elastic that other syllables (Glaze & Troyer, 2006). In 4 out of the 9 birds in our sample, these syllables are composed of a single intro-like note, while only 3% of all notes are intro-like and only 2 out of 7 intro-like notes were in a different motif position (one bird's motif began with an intro-like note repeated twice; the second is excluded from this number). Thus, it is possible that motif position explains the difference in elasticity rather than spectral type per se. The sample is too limited to tease apart motif position from spectral type.

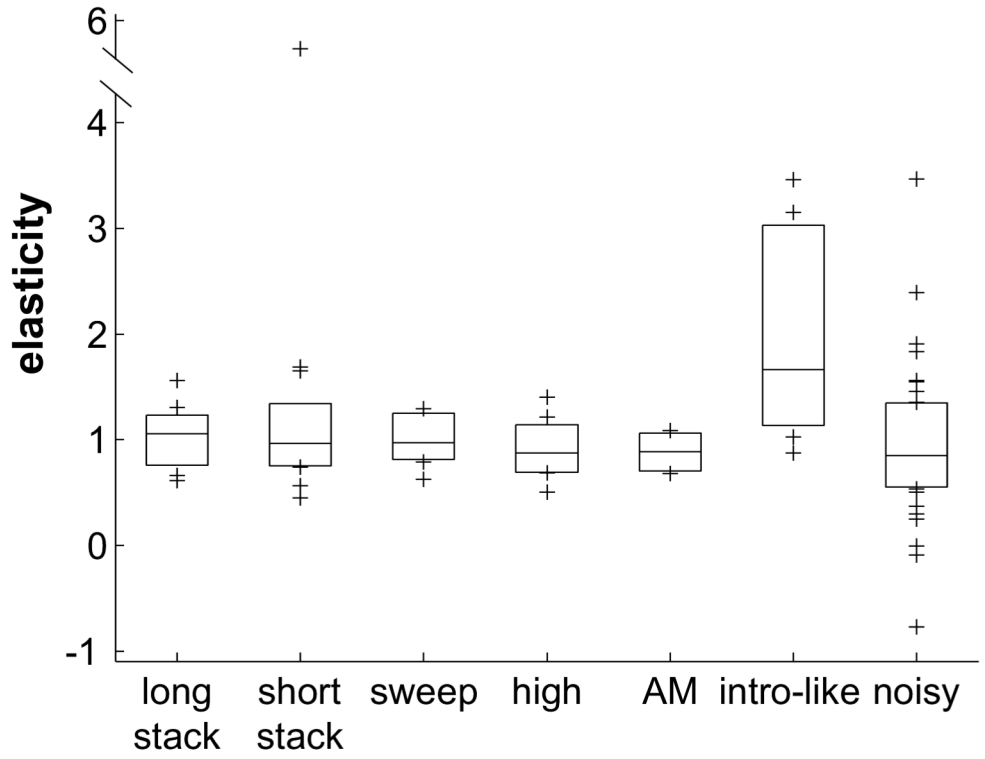

Figure 6. Distribution of elasticity coefficients by note type. For each box, upper and lower edges indicate 75th and 25th percentiles of the distribution, while the middle bars indicate median. "+" denotes data points outside the 75th and 25th percentiles.

Residual variability

We also asked whether there were significant differences across note types in the variability that remains after factoring out tempo. Fig. 7 shows residual standard deviation by mean length for all notes categorized by type. The dashed line indicates mean coefficient of variation (CV = standard deviation / mean) across notes; points above this line reflect a CV greater than the mean CV. (Fig. 7). Notes that are high, intro-like or noisy (filled symbols) have significantly greater CV than the rest (WSM, $p < 0.001$; mean among these three types is $6.95 \pm 0.70\%$, among the rest, $3.71 \pm 0.27\%$).

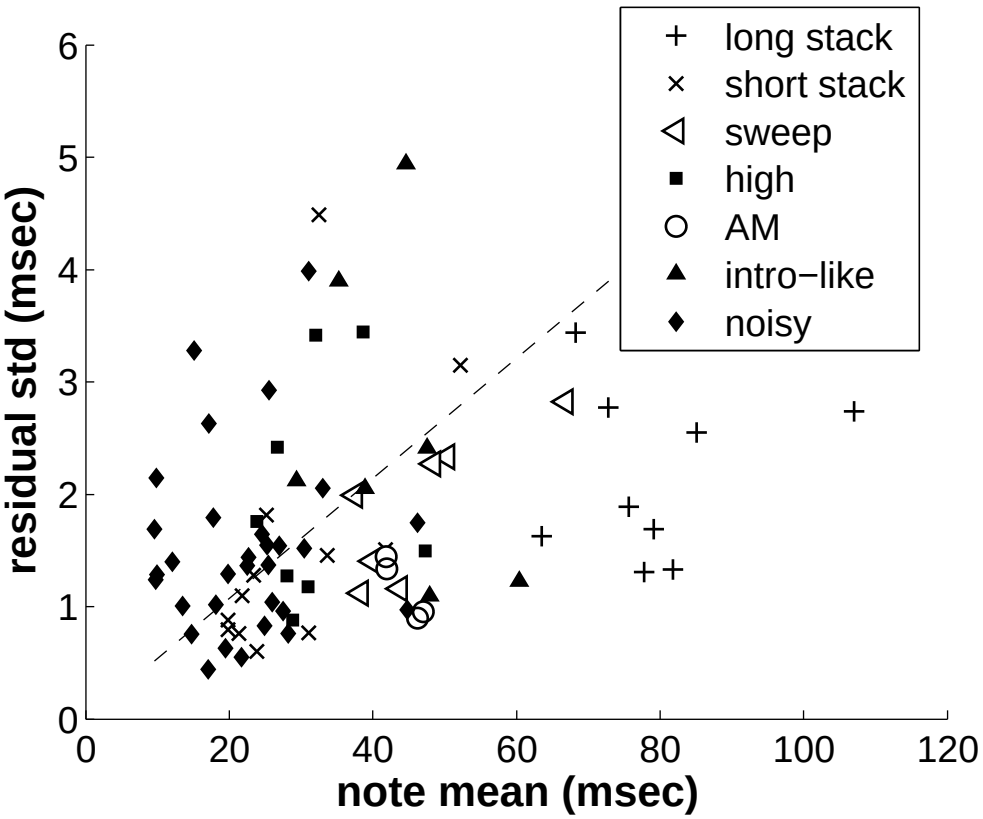

Figure 7. Residual standard deviation by mean length across notes. Dashed line indicates mean standard deviation per length across all notes, so that points above this line indicate notes with a residual standard deviation per length that is larger than average. Filled symbols indicate note types that have significantly more residual variability per msec of mean length.