# Discreteness and the musilanguage continuum

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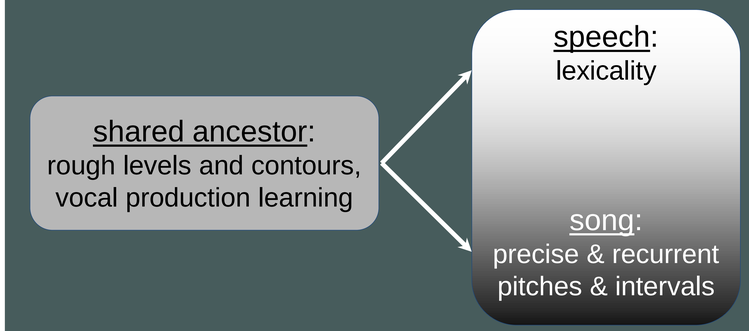
## BACKGROUND

Speech and song have both shared and distinct features – structurally, functionally and cognitively

Both are ancient, innate, and universal

Their related forms and functions might be due to a shared evolutionary history

MUSILANGUAGE PRECURSOR




**FUNCTIONAL** DIVERGENCE?

- Parent-infant and social-emotional bonding?
- Social cohesion and synchronization?
- Cultural transmission and memory?

**STRUCTURAL** DIVERGENCE?

- Lexicality
  logogenic (all words) → melogenic (all melody)
- Pitch- & interval-class discreteness
  → emergence of intervals, scale steps, meter
- Recurrence
  unique utterances → repetitive form
- Texture
  dialogic → solo → choric
- Expansion
  → increasing pitch/interval range, vowel duration

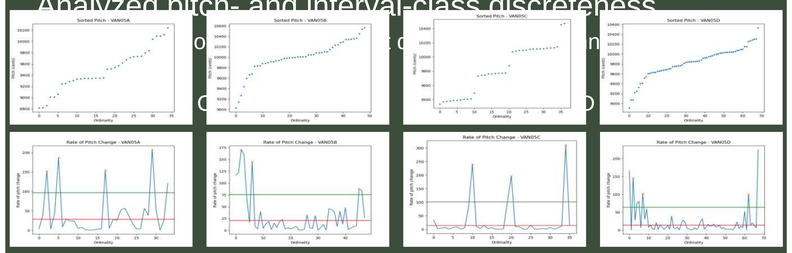
## METHODS

Corpus of cross-cultural recordings: Hilton et al. 2022
Used 4 samples from 19 regions (76 tracks total):

A. Infant-directed song
B. Infant-directed speech
C. Adult-directed song
D. Adult-directed speech

Segmented into notes (song samples) and syllables (speech samples) using Tony

Analyzed pitch- and interval-class discreteness




Conducted basic MIR using Essentia to extract important spectral, rhythmic, and tonal features

Screened data for correlated predictors, collinearity (VIF) & outliers (Cook's distance)

| Full model: | Discreteness model: | Spectral model: | Rhythm/tonaity model: |
|---|---|---|---|
| pitchclass-r2 | pitchclass-r2 | | |
| pitchclass-stepiness | pitchclass-stepiness | | |
| pitchclass-flatness | pitchclass-flatness | | |
| pitchclass-inertia | pitchclass-inertia | | |
| pitchclass-silhouette | pitchclass-silhouette | | |
| intervalclass-r2 | intervalclass-r2 | | |
| intervalclass-stepiness | intervalclass-stepiness | | |
| intervalclass-flatness | intervalclass-flatness | | |
| intervalclass-inertia | intervalclass-inertia | | |
| intervalclass-silhouette | intervalclass-silhouette | | |
| pitch salience (mean) | | pitch salience (mean) | |
| pitch salience (stdev) | | pitch salience (stdev) | |
| spectral complexity (mean) | | spectral complexity (mean) | |
| spectral energy (mean) | | spectral energy (mean) | |
| spectral energy (stdev) | | spectral energy (stdev) | |
| spectral flux (mean) | | spectral flux (mean) | |
| spectral rolloff (mean) | | spectral rolloff (mean) | |
| beats count | | | beats count |
| bpm | | | bpm |
| diatonic strength | | | diatonic strength |
| ET deviation | | | ET deviation |

## RESULTS

| | Null model | Full model | Discreteness model | Spectral model | Rhythm/tuning model |
|---|---|---|---|---|---|
| Residual Deviance | 187.95 | 40.1 | 99.31 | 122.01 | 164.83 |
| Likelihood-ratio Chi-square | 0, df=0, p=1 | 147.85, df=-63, p<0.001 | 88.64, df=-30, p<0.001 | 65.94, df=-21, p<0.001 | 23.12, df=-12, p<0.005 |

Pitch- and interval-class discreteness are significant predictors of vocalization type cross-culturally

Our discreteness models performed equal to or better than our MIR models at predicting vocalization type

## DISCUSSION

- Discreteness calculations still under development
- Small sample size, especially for split-set classification analyses
- Interaction and higher-order terms?
- Perhaps different results if the vocalization type was dichotomized (speech vs song) for binomial regression?

## FURTHER WORK

- Isolate features of proposed structural axes using synthesized samples, then collect ratings along a continuum from speech to song
- Explore classification and rating with more naturalistic intermediates along the musilanguage continuum (e.g. chant, poetry)
- Investigate relationships between manipulations of the structural axes, musilanguage ratings, and behavioural effects (e.g. memory, synchrony)