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# Protocol for scoring animal calls on structural acoustic features prevalent in human music

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## ABSTRACT

The following protocol was developed using ethnomusicological universals rhythm, tone, interval, repetition, transposition, and syllable diversity in order to look for them in animal calls. The literal feature definitions themselves are merged from various musical dictionary sources. And the spectrographic examples are from bird calls and songs.

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## ABSTRACT

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## For trainer

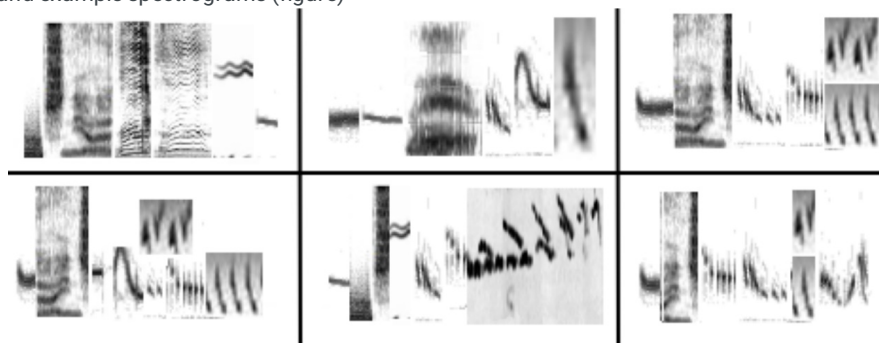
- 1 Sample spectrographic repertoires from the literature
- 2 Screen capture or scan each figure and name it systematically e.g. genus-species-voc#-name-author-year-figure.png

- 3 Generate a list of vocalizations (in rows) from literature for recording info above (in columns)
- 4 Give each vocalization a globally unique identifier (e.g. 3 digits for hundreds of calls)
- 5 Create a scoring table for each of your scorers using the following: a. use the list of vocalizations but add a uniquely randomized score id column b. sort the table by this new, randomized score id column. c. add feature columns across the top for structural acoustic features you would like to score d. hide the columns relating to genus, species, name, author, & year
- 6 Use these new scoring tables to generate a new directories for each vocalization (titled by score id)
- 7 Gather training materials from literature and reference texts; make these tangible via screenshots or via print outs of definitions (table)

acoustic feature	definition	spectrographic	scoring
tone	a steady, regular, or periodic sound characterized by its pitch (or perceived frequency), intensity, duration, and timbre	presence of a clean, high-contrast fundamental frequency and/or harmonics	low={noisy, pixelated, grey} high={clean, clear, black & white}
interval	the difference between two (successively sounding) tones. The ratio between two sonic frequencies	the presence of sloping or curving (rather than static) fundamental frequency within units	low={flat or noisy} high={sloped, jagged or curvey}
rhythm	a regular recurrence or pattern in time--a movement marked by the regulated succession of strong and weak elements, or of opposite or different conditions	the regularity of spacing between units over time	low={unpredictable horizontal spacing of units} high={evenly spaced repeats, scale or syllables}
repetition	restatement [over time], such as the restatement of an utterance, phrase, or theme.	reappearance of a syllable at the same frequency across time	low={isolate, unique} high={all units match many other units horizontally}
transposition	moving a (collection of) note(s) up or down in pitch by a constant interval	reappearance of a syllable at different frequencies over time	low={flat progression} high={all units match other units after shifting vertically and horizontally}
syllable(s)	a unit of organization for a sequence of speech sounds. Typically made up of a syllable nucleus (most often a vowel) with optional initial and final margins (typically, consonants).	a count of the number of distinct unit shapes within a call	low={one unit shape type} High={many unit shape types}

Vocalization spectrogram component definitions and scoring key. Listed here are our six structural acoustic features universal to human music, their definitions, and a spectrographically relevant interpretation for scoring purposes. The first five dimensions were scored on a scale of 1 (lowest) to 10 (highest), while syllable was scored as a count of different spectral shapes.

and example spectrograms (figure)



Tone, interval, rhythm (top row), repetition, transposition, and syllable count (bottom row)

Avian example spectrograms used for feature scoring training. Tone, interval, rhythm (top row), repetition, transposition, and syllable count (bottom row) from low (left) to high (right). The syllable counts (bottom right) are: 1, 2, 3, 3, 3, 4 (approximately)

- 8 Post these on screen at a computer lab where training and scoring take place
- 9 Pass out printed or digital copies of these for reference during the remainder of the scoring session
- 10 Answer any clarifying questions before the session starts

For scorer

- 11 Read the instructions for scoring (step 7) as well as printed or digital definitions (table and figure)
- 12 Iterate through each vocalization (do each of the following for each vocalization in your spreadsheet) a. rate, on a scale of 1-10, how tonal, intervalic, rhythmic, etc. each vocalization type is and enter it b. count the number of different types of syllables or shapes and enter this in the syllables column