Modeling Performance on Aural Skills Examinations

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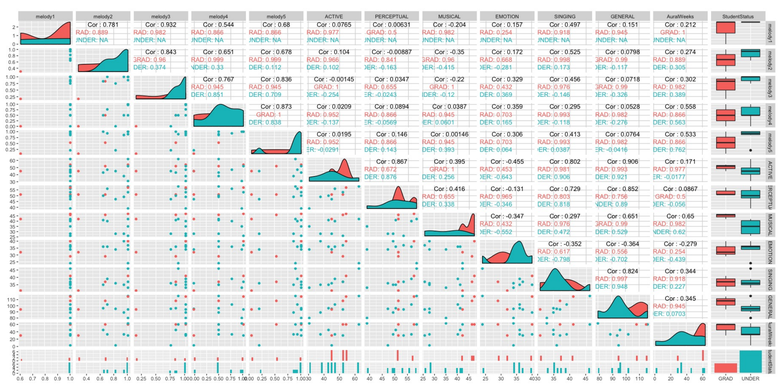
Background

- Despite prevalence in curriculum, research on aural skills at the University level is limited at best (Wolf, Platz, & Kopiez, 2011)
- Sizeable literature exists from music cognition literature on memory for melodies (Halpern & Bartlett, 2010)
- Structural features of melody also contribute to memory recognition rates (Burgoyne, Bountouridis, Van Balen, Honing, et al., 2013; Dowling, 1978; Dowling & Fujitani, 1971; Halpern & Müllensiefen, 2008; Baker and Müllensiefen, 2017)
- Individual difference factors also may play a role in musical abilities (Colley, Keller, & Halpern, 2017; Meinz & Hambrick, 2010)

Table 1: Total Hypothesized Factors

Individual Differences	Musical Features
Musical Training	# of Notes in Melody
Aural Skills Training	Length of Melody
Absolute Pitch	Information Content
Auditory Imagery	Tonalness
Cognitive Ability	Range
Attention	Tessitura
Long Term Memory	Contour Variation
Music Theory Abilities	Tempo
Anxiety	Timbre or ASDR

Descriptives



Modeling Plan

Cognitive Factors
Operation Span
Tone Span
General Fluid
Training Factors
Musical Sophistication
Music Theory Training
Sing Back
Musical Parameters
Length
Complexity
Number of Notes

Pilot Experiment

Sample of students currently enrolled at University (N=11) took part in a pilot experiment in which they performed five melodic dictations on relatively short melodies. Participants heard melodies 5 times with 30 seconds between each hearing and 120 seconds after the last hearing. After experiment, participants filled out surveys measuring their musical sophistication (Goldsmiths Musical Sophistication Index), auditory imagery abilities (Bucknell Auditory Imagery Scale), and aural skills background.

Stimuli

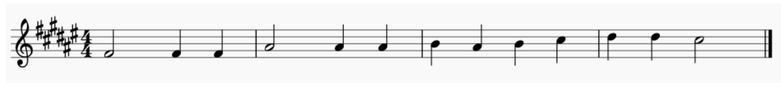


Figure 1: Mary

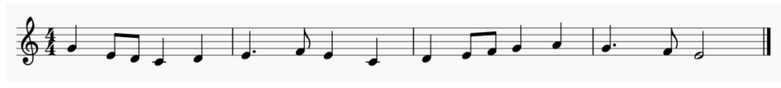


Figure 2: Deck

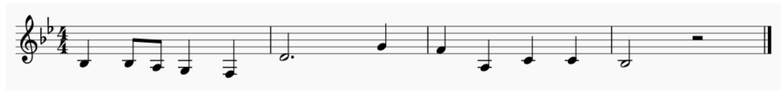


Figure 3: Jingle

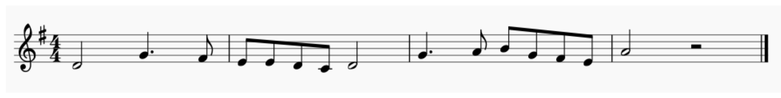


Figure 4: Yankee

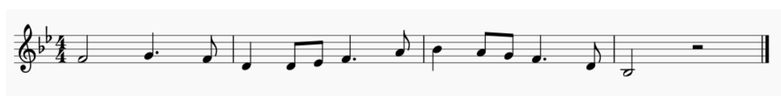


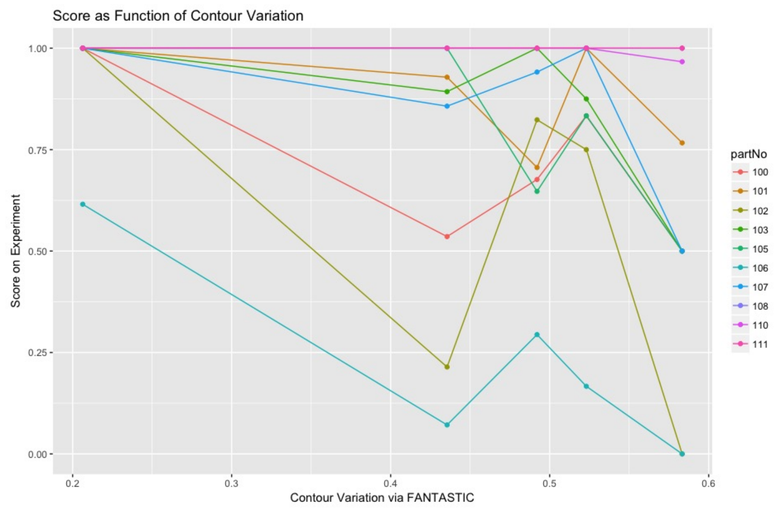
Figure 5: Doremi

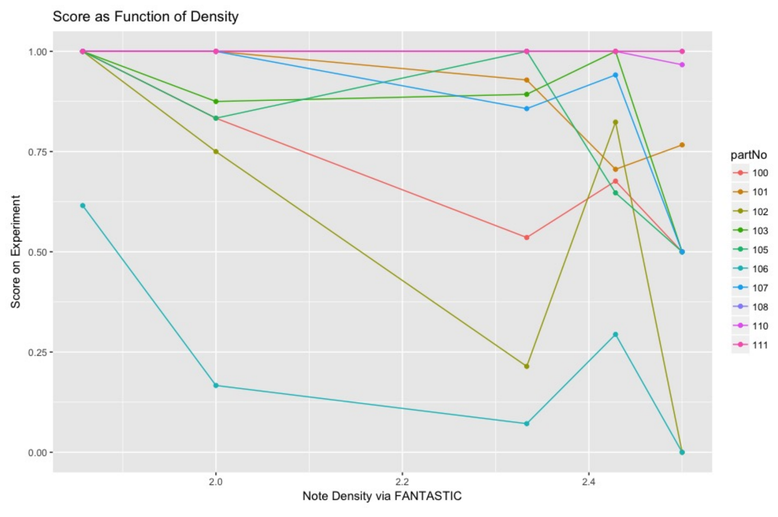
Feature Extraction

Drawing on previous literature, six features were hypothesized to contribute to the complexity of a melody. Future optimization of stimuli will explore more features.

- Interval Range: Distance in semitones from lowest to highest note
- Interval Entropy: Variety of intervals used (Information Content)
- Length: Number of note onsets
- Note Density: Notes divided by time
- Tonalness: Pitch Content Compared to Krumhansl-Schmuckler Profile
- S.L. Contour Variation: Measure of Melody Direction Change

Analysis





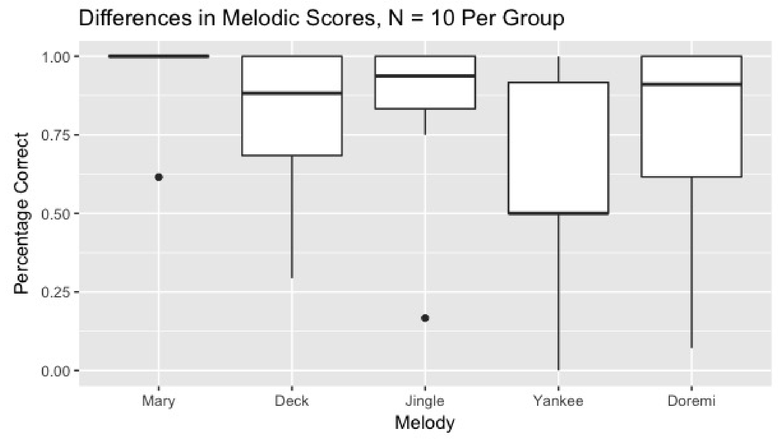


Figure 6: Distribution

Differences Between Melody Difficulty RMANOVA

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Btwn Part	9	2.61	0.29		
Melody	4	0.81	0.20	7.77	0.0001
Error	36	0.94	0.03		

Future Directions

- Data suggest that tools from computational musicology could be used to determine difficulty of task in Aural Skills dictation setting
- Need to optimize parameters to prevent ceiling and floor effects
- Build individual models with more data examining role of individual differences at cognitive and training factors

Melody	Interval Range	Interval Entropy	Length	Note Density	Tonalness	S.L. Contour Variation
Mary	9	0.500	13	1.860	0.850	0.210
Deck	9	0.500	17	2.430	0.780	0.490
Doremi	12	0.640	14	2.330	0.790	0.440
Jingle	14	0.560	12	2.00	0.800	0.520
Yankee	11	0.530	15	2.500	0.880	0.580