APPLYING THE WORK OF BREGMAN, KRUMHANSL, AND NARMOUR TO THE STUDY OF MELODIC VOCAL INTONATION

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1. HYPOTHESES

- That pitches at the peaks and valleys in the melodic contour are more noticeable (Bregman 1989, 475), and thus the preceding and succeeding intervals are tuned more consistently with one another than the other intervals of the same type (semitones or whole tones)
- That there is a significant difference in average interval size related to the size of semitones and whole tones by
  - The simplified version of Narmour's Implication-Realization model proposed by Schellenberg (1996)
  - The melodic attraction model described in Lerdahl and Krumhansl (2007)

2. DATA

- Schubert's "Ave Maria"
  - 3x a cappella & 3x accompanied
  - 6 professionals and 6 non-professionals
- Melodic semitones and whole tones analyzed
  - Note locations estimated with MIDI-audio alignment
  - F_0 estimated with YIN (Kawahara and deCheveigné)
  - Perceived pitch estimates using algorithm in Gockel, Moore, and Carlyon (2001)


3. PREVIOUS FINDINGS

- TUNING SYSTEMS: No strict adherence, on average smaller than equal temperament (more so for semitones)
- DIRECTION: Ascending semitones 7–8 cents larger
- EFFECT OF TRAINING
  - Pros were more consistent with one another
  - Pros' semitones were 6 cents larger on average
  - Non-pros tended to compress leading tones
  - Non-pros' accompanied semitones 3 cents larger
- Overall there is a large amount of variation in the data that could not be explained by the factors considered

4. RESULTS

- "BREGMAN" - MELODIC PEAKS AND VALLEYS
  - Semitones exhibited a significantly smaller variance on average when the interval approached or left a melodic peak or a valley ($F(1, 945) = 0.88$, $p < 0.05$) while whole tones sizes did not exhibit any significant difference
  - The difference between semitones and whole tones for the melodic contour analysis mirrors differences between semitones and whole tones in previous findings
- "NARMOUR" – PITCH REVERSAL
  - Intervals were labeled in terms of the results of pitch-reversal calculation proposed by Schellenberg (registral direction + (1.5) registral return)
  - An ANOVA showed a significant difference between the size of both the semitones ($F(1, 1278) = 23.24$, $p < .0001$) and whole tones ($F(1, 1945) = 21.32$, $p < .0001$) with a pitch-reversal value of 2.25 versus a those with a value of 0, with opposite effects for size
  - Linear regression showed this only explained a very small amount of the variation in the data (*r = 0.01*)
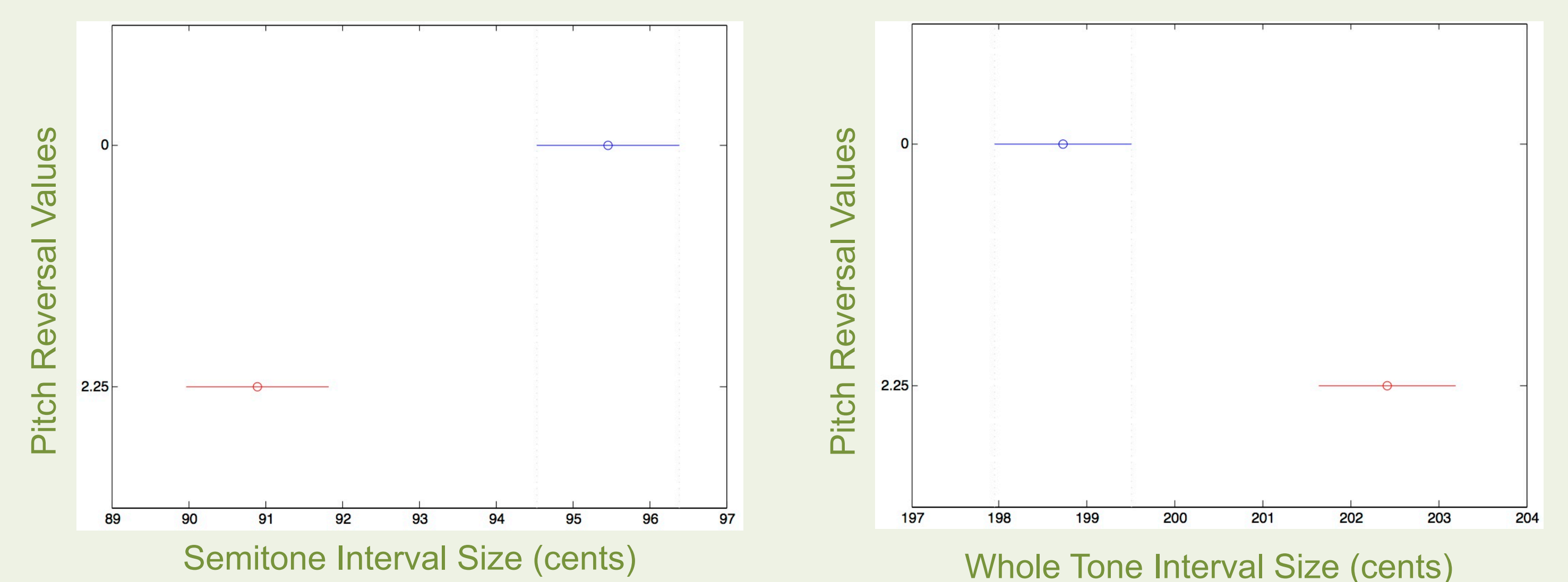
- "KRUMHANSL": MELODIC ATTRACTION
  - The melodic attraction values were treated as categorical variables
  - An ANOVA analysis showed significant differences between conditions for both semitones ($F(1, 1275) = 23.52$, $p < .0001$) and whole tones ($F(1, 1940) = 8.98$, $p < .0001$)
  - Linear regression showed this only explained a very small amount of the variation in the data for both semitones (*r = 0.03*) and whole tones (*r=0.01*)