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Can Musicians Tell Sharp From Flat?

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Background

- A fine command of intonation is an important skill for many different musical activities.
- Research has found that both musicians and non-musicians can easily detect intonation errors (i.e. “when something is out of tune”), but both types of listeners are poor at distinguishing the directionality of mistuned notes (i.e. “sharp and flat” notes) (Siegel and Siegel, 1977)
- This research replicates the methodology of Siegel and Siegel (1977), in which listeners were asked to classify “mistuned” musical intervals as being sharp, flat, or in-tune. Several refinements and additions to the original study were made, including using more ecologically valid stimuli, and automating data collection through specially designed experimental software (MAX/MSP)
- We hypothesized that, consistent with the results of Siegel & Siegel (1977), musician participants would perform at or below chance level (33%) when asked to classify the directionality of mistuned intervals.
- If participants are unable to correctly classify the directionality of intonation errors, the results would support the theory that musical intervals are perceived categorically rather than absolutely.

Methodology

- Participants: 10 Illinois Wesleyan University music majors.
- Stimuli: Ninety (90) tuned and mistuned melodic musical octaves presented in a randomized order. Intonation errors were measured in cents (100 cents equals the musical interval of a minor 2). Intonation error size ranged from 5 to 100 cents.

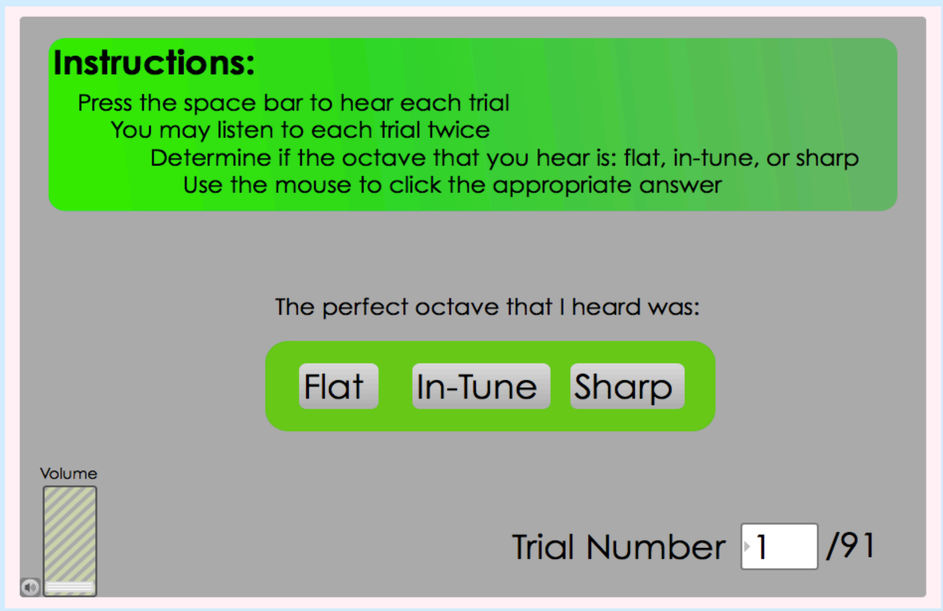

Figure 1. Picture of the experimental interface (MAX/MSP)

Results

Participant #	Total Number Correct	Correct Sharp answers	Correct Flat answers	Correct in tune answers
Participant 1	42 (46.67%)	18 (42.85%)	15 (35.71%)	9 (21.43%)
Participant 2	61 (67.78%)	25 (40.98%)	26 (42.62%)	10 (16.39%)
Participant 3	46 (51.11%)	12 (26.09%)	24 (52.17%)	10 (21.17%)
Participant 4	46 (51.11%)	21(45.65%)	16 (34.78%)	9 (21.43%)
Participant 5	44 (48.89%)	18 (40.91%)	14 (31.82%)	12 (27.27%)
Participant 6	32 (35.56%)	5 (15.63%)	17 (53.13%)	10 (31.25%)
Participant 7	36 (40%)	15 (41.67%)	10 (27.78%)	11 (30.56%)
Participant 8	47 (52.22%)	17 (36.17%)	19 (40.43%)	11 (23.4%)
Participant 9	44 (48.89%)	19 (43.18%)	16 (36.36%)	9 (20.45%)
Participant 10	62 (68.89%)	28 (45.16%)	25 (40.32%)	9 (14.52%)
Average	45.9 (51.11%)	17.8 (37.83%)	18.2 (39.51%)	10 (22.79%)

Table 1. Accuracy of each participant, including the division of sharp, flat and in tune intervals, and the averages of participant scores for sharp, flat, in tune and overall answers.

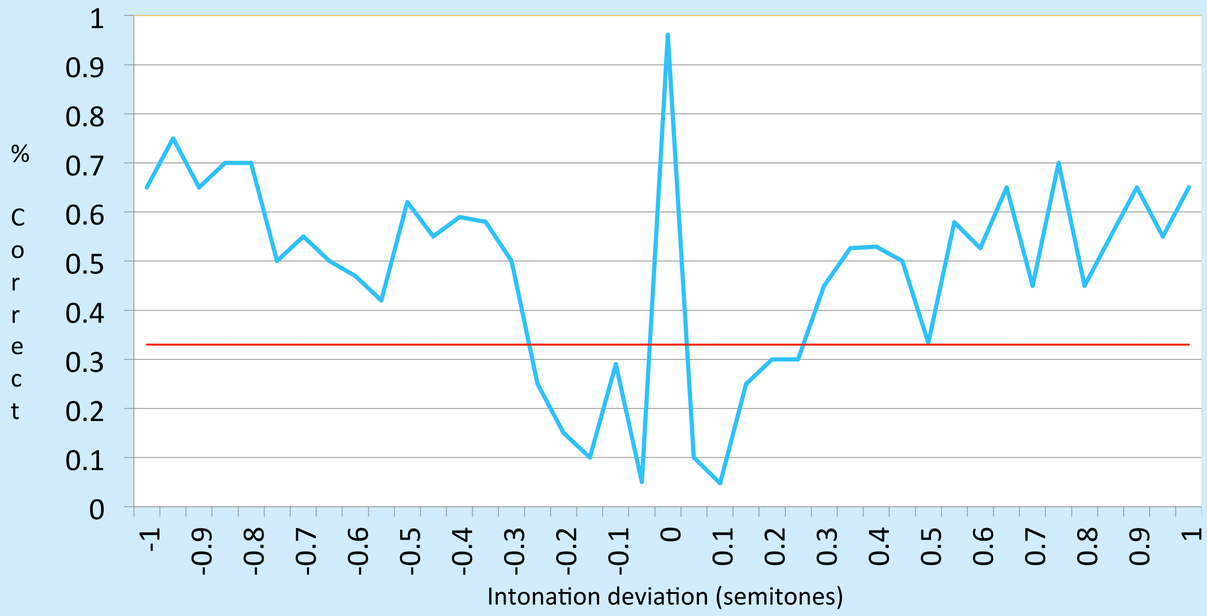

Figure 2. Average percentage correct as a function of intonation error (in semitones). The horizontal chance line depicts chance level performance (33%).

Discussion & Future Work

- When intonation errors were less than 30 cents in either direction, participants responded below chance level, meaning that participants were guessing whether the interval was sharp or flat.
- Participants successfully identified most of the “in-tune” intervals.
- The results were consistent with the hypothesis that musical intervals are perceived categorically rather than absolutely.
- Future studies might recast this experiment within a richer musical context, as well examine the difference between the directionality of intonation errors (i.e. Are sharp and flat intervals similarly perceived?)

References

Siegel, J & Siegel, W. Categorical perception of tonal intervals: Musicians can’t tell sharp from flat. *Perception & Psychophysics,* 1977, 21 (5), 399-407.