Progress from Analytic to Global Perception of Modulations with Increased Familiarity with Music

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Tonal Hierarchy

- Provides a framework for encoding the pitches of a melody

- Selects 5-7 pitches out of the 12 semitones to form a "scale"

- Establishes a tonal center—"tonic" pitch—and a hierarchical pattern of importance of the other pitches

- This can be seen in tonal profiles that describe the hierarchies in different keys

Two Western Tonal Hierarchies

- Krumhansl & Kessler (1982)
- Key profiles
- Notice "in-scale" vs. "out-of-scale" pitches
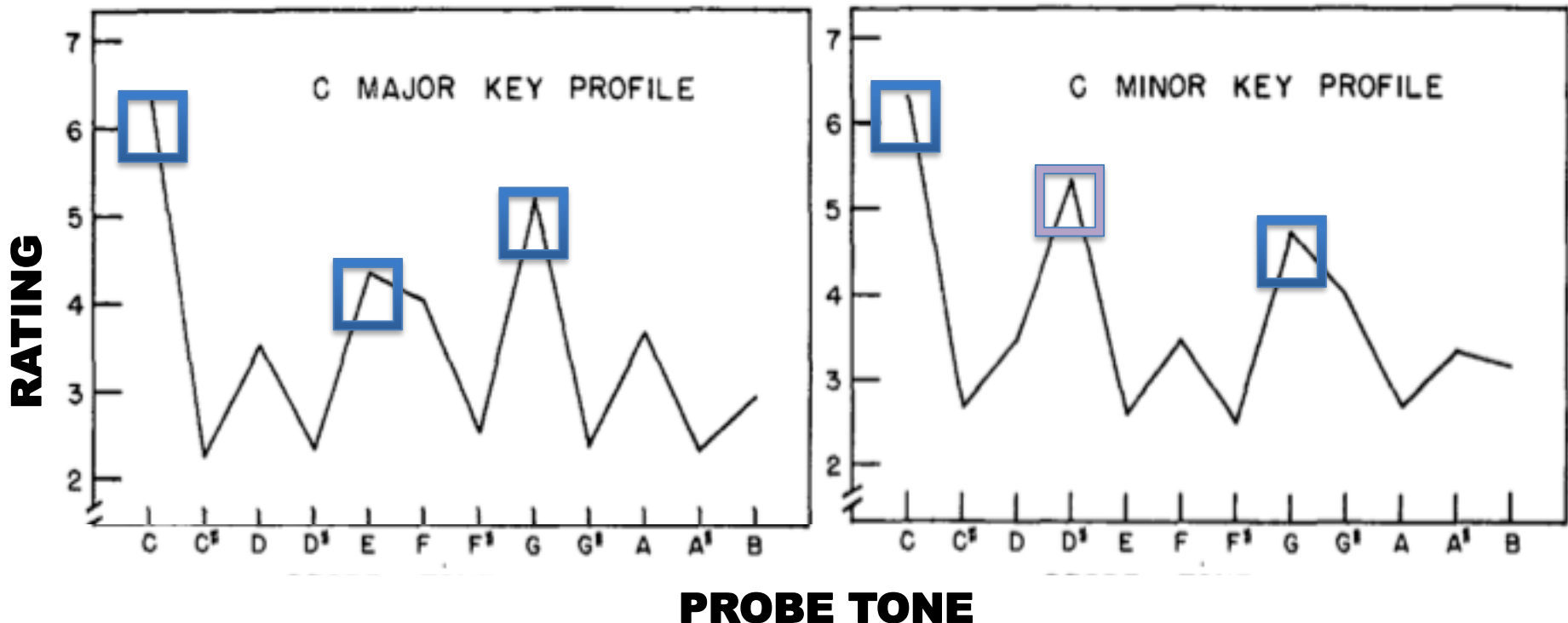
Modulation

- Modulation from one "key" to another involves replacing the tonal profile with a new one. This can involve:
  - Changing the set of pitches (e.g., C major to C minor)
  - Changing the tonal center (e.g., C major to A minor)
  - or both (e.g., C major to A major)
- Modulation can take us to a closely related key that shares many pitches with the starting key (e.g., C major to G major), or to a distant key that doesn't (e.g., C major to B major)
- Close modulations often heard simply as variants of the original key (tonic-dominant)

Experiments

- Listeners hear a musical excerpt in one ear, along with a probe tone in the other ear (one of the 12 possible semitones—Toiviainen & Krumhansl, 2003)

- They rate the probe tone continually for how well it goes with the music by moving a slider on the screen

- They go through the excerpt 12 times, each time with a different probe

- Different listeners hear the 12 probes in different orders, randomly determined

Experiments

- We use the ratings to put together tonal profiles that may change as the listener progresses through the piece

- We correlate those profiles with the standard profiles for the possible keys that the listener will encounter

- If the listener is following the modulations in their ratings, the correlations will show the shifts from key to key

Experiment 1

- There are two kinds of modulation in Carnātic (South Indian classical) music: grahabēdham (like C major to A minor), and rāgamālikā (like C major to C minor)

- We used one excerpt of each type, about 1 min long

- 10 Indian & 10 Western music teachers participated

- The Indian teachers were familiar with the excerpts, especially the rāgamālikā excerpt, whereas Western teachers were unfamiliar with both excerpts
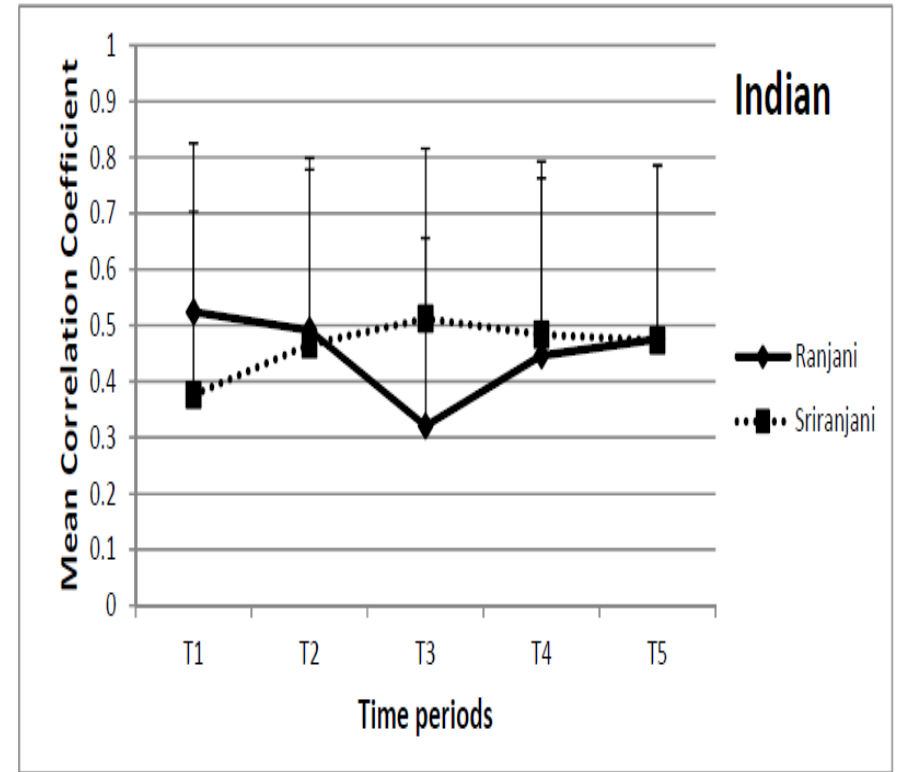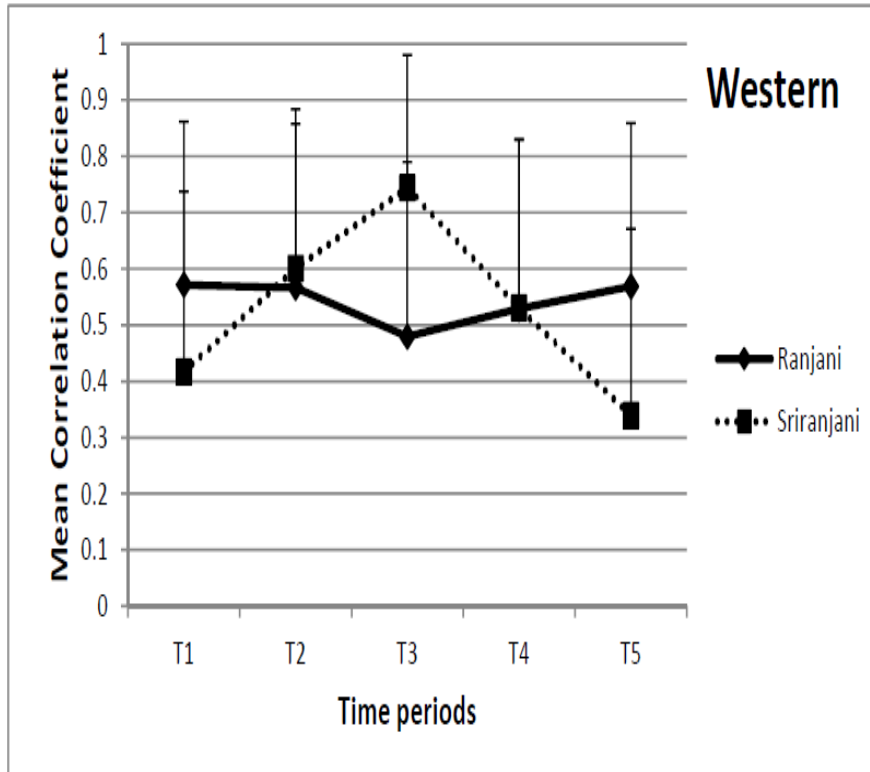
Grahabēdham

(Raman & Dowling, 2016)
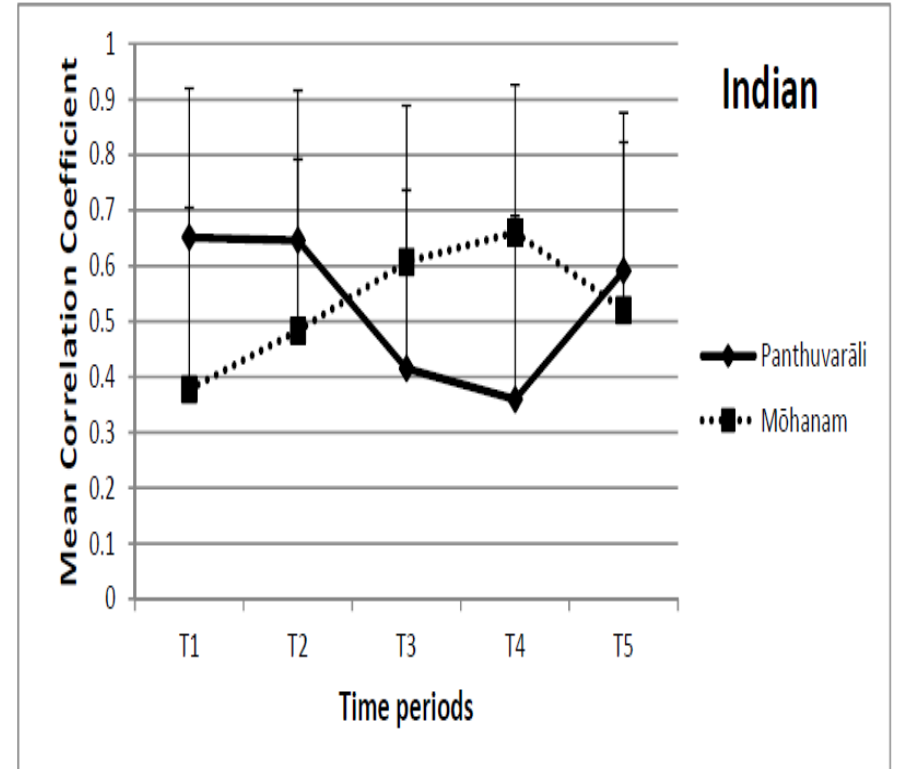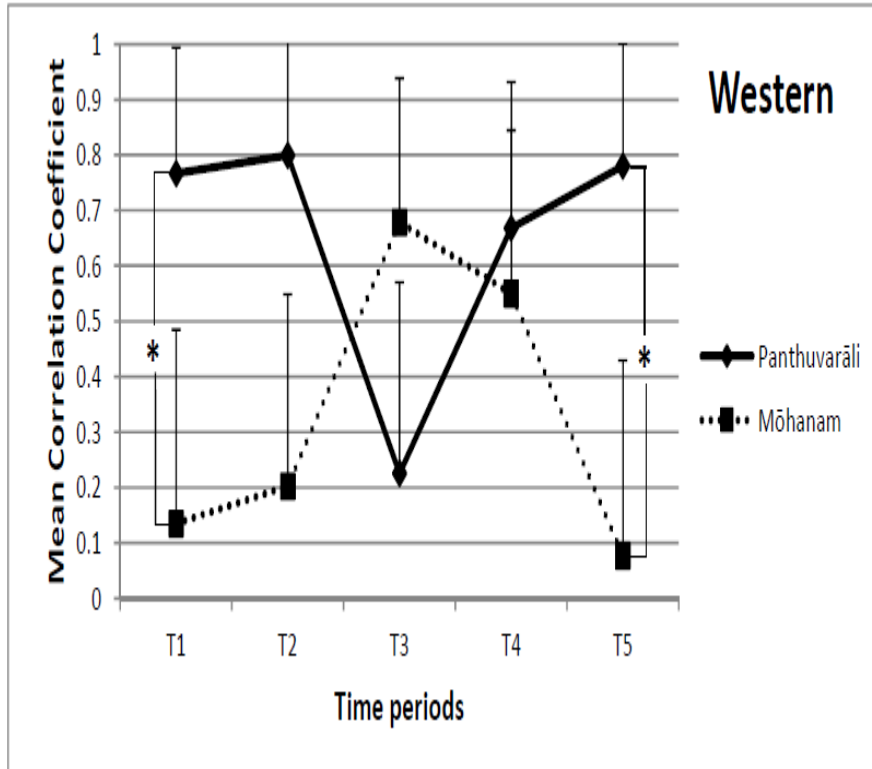
Rāgamālikā

(Raman & Dowling, 2016)

Results

- Clearly, the Indian teachers were responding in a more global fashion to the modulations than the Western teachers, who were more analytic.

- Could this global responding be due to their greater familiarity with the pieces?
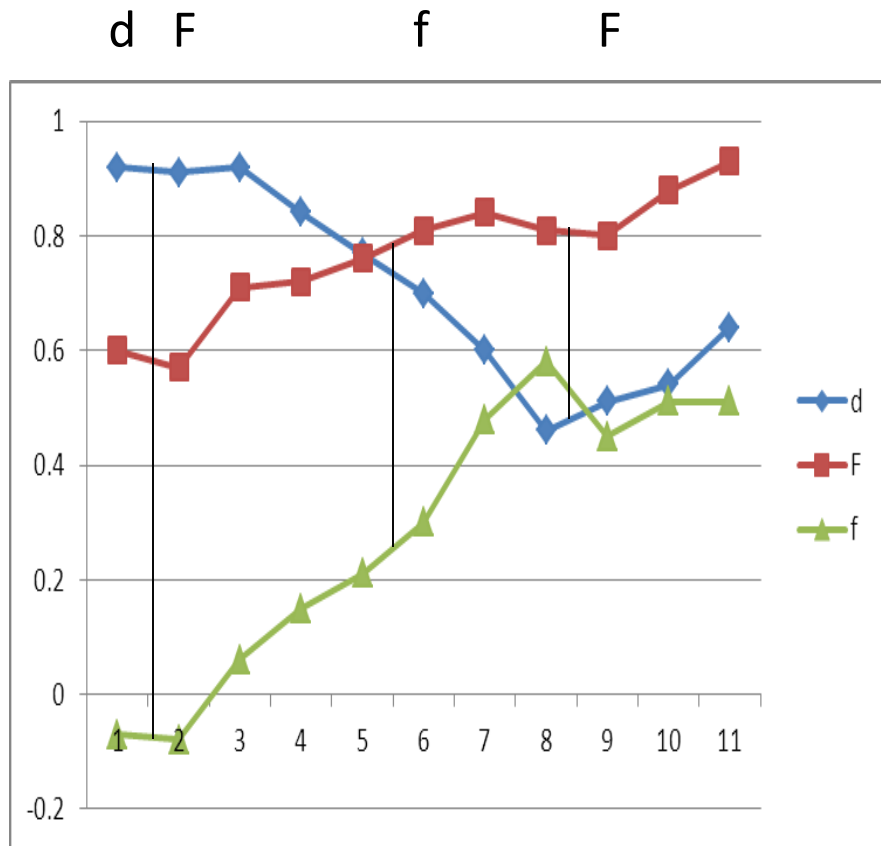
Experiment 2

- In Experiment 2, we were able to look at possible effects of increasing familiarity

- Since listeners heard the excerpts 12 times in the continuous probe-tone method, we could look at their responses during the first 3 trials compared with the last 3 trials

- The excerpts were the first 2 min of Haydn's Quartets op. 76, no. 2 ("Quinten") and op. 76, no. 3 ("Emperor"), starting at the beginning and stopping at the end of the exposition section

- The excerpts contained 3 or 4 modulations:
  - d minor, F major, f minor, F major
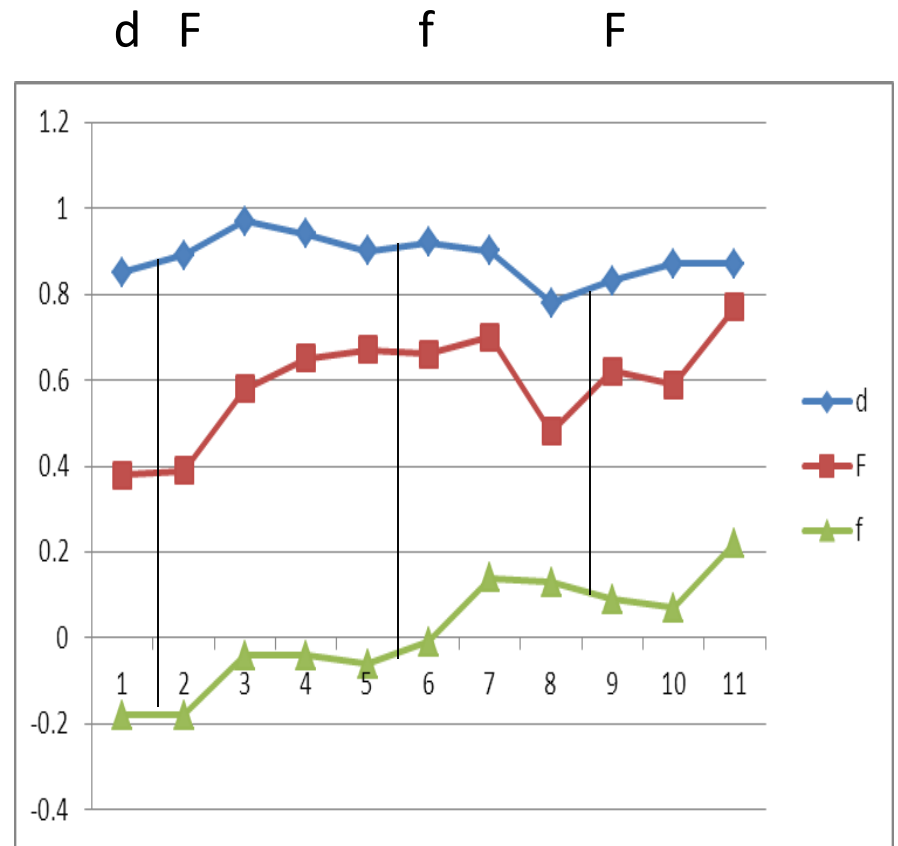 - C major, G major, g minor, E^b major, G major

Experiment 2

- Blocks of 12 listeners with the same level of musical training complete a Latin square, so that for each trial each of the 12 probes is represented

- We will look at the responses of the 60 listeners with more than 5 years of musical training
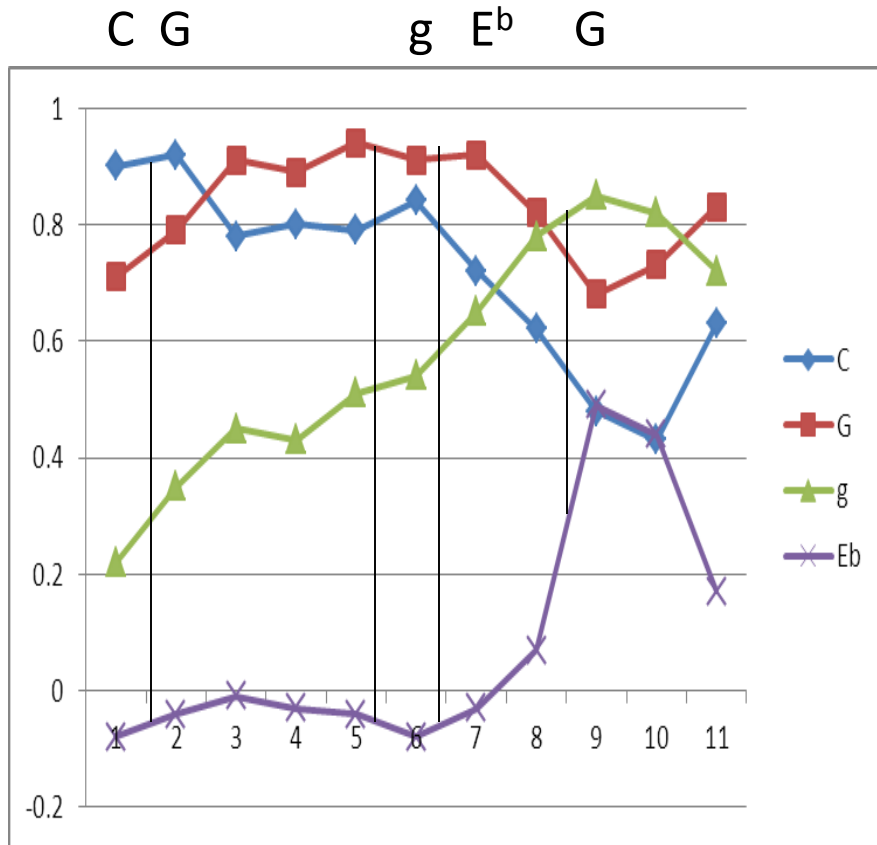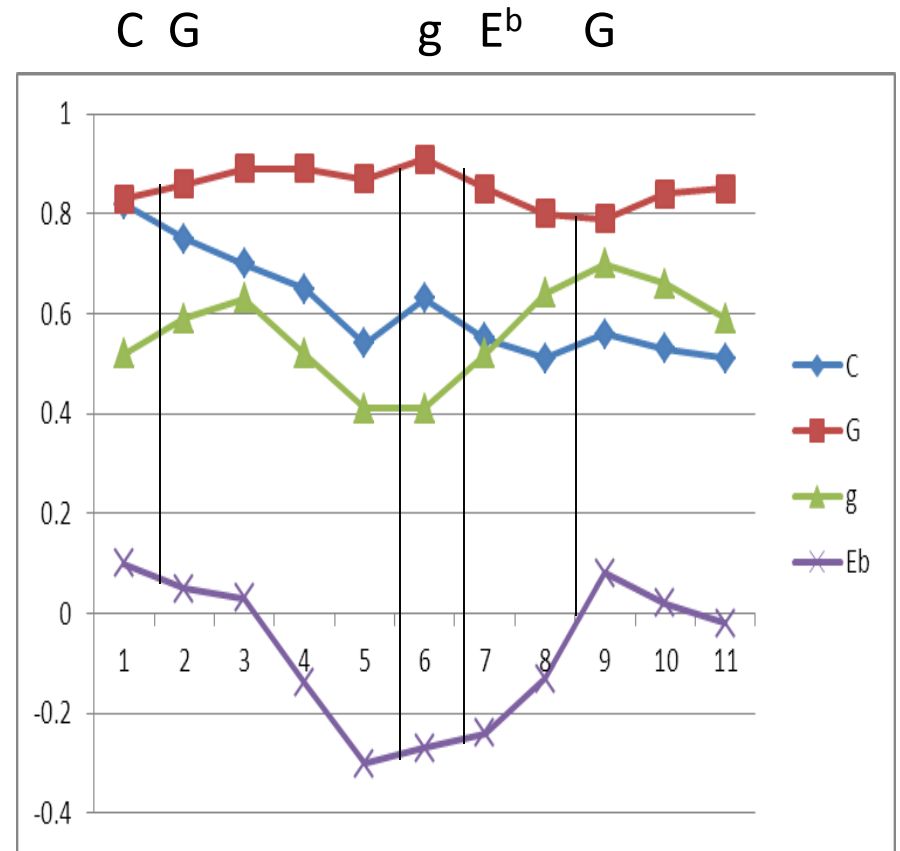
76/2 Musicians

trials 1-3   trials 10-12

76/3 Musicians

trials 1-3

trials 10-12

Experiment 3

- This led us to manipulate familiarity even more strongly

- 12 student orchestra members performed the task with a piece they were going to learn, but had not seen yet (the finale of Dvorak's "American" String Quartet)

- Then they did the task in the middle of the semester after practicing the piece for 6 weeks, and finally after playing the piece in their concert
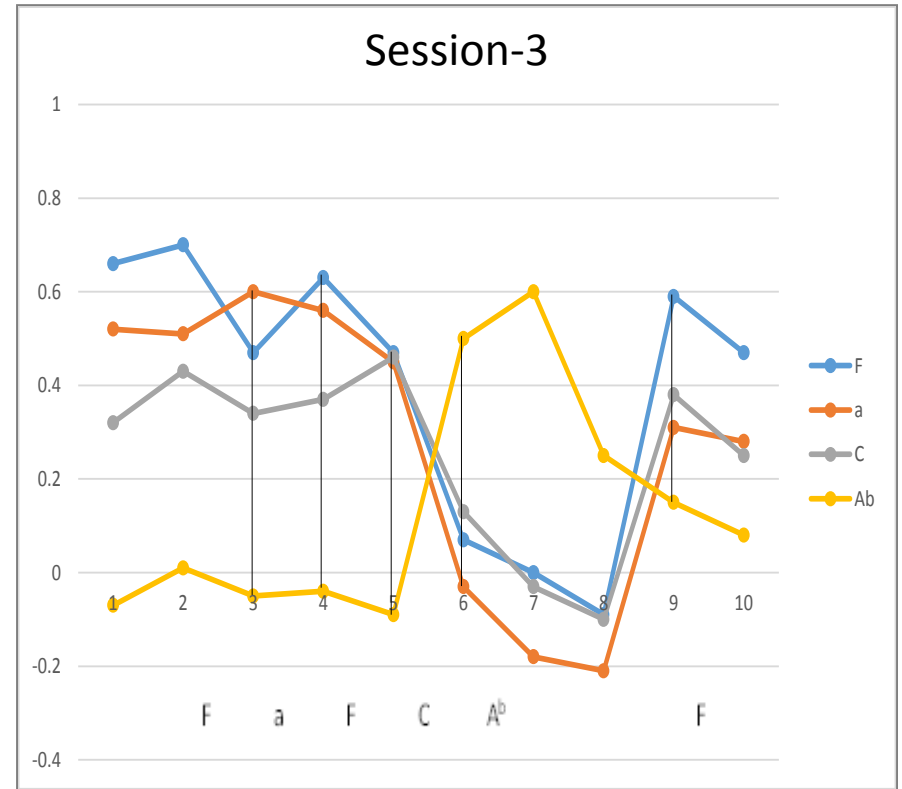
Experiment 3

- There were 5 modulations in the first 2 min of the piece, involving 4 keys:
  - F major
  - A minor
  - C major
  - A^b major
- We looked at sessions 1 and 3, where the difference in familiarity was strongest

Dvorak
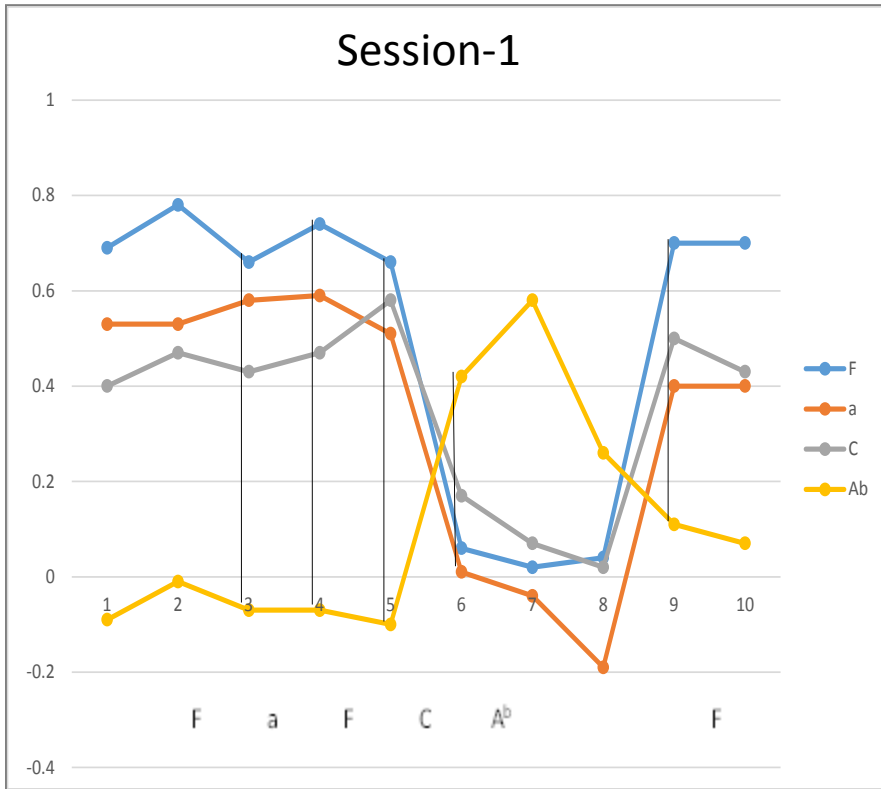
Results

- ANOVA: 2 Sessions X 10 Time Periods X 4 Keys

- Strong Period X Key interaction, $F(27,297) = 27.30$, $p<.001$

- The only interaction involving session was Session X Key, $F(3,33) = 2.39$, $p<.09$, in which the key means were more spread out in Session 1

- This could be taken as a very indirect indication of a global shift, but clearly these listeners started out and finished with sharp differentiations among keys

Conclusions

- In some cases there are indications of a tendency toward more global perception with increasing familiarity (Indian vs. Western differentiation of Indian modulations; loss of sharp differentiation throughout a session by more experienced musicians)

Conclusions

- However, our attempt at manipulating familiarity with the orchestra members failed to show convincing evidence of a shift from analytic to global perception

- It may be that the demands of playing the piece helped maintain those listeners in their more analytic mode

- This might contrast with familiarity derived from listening, where expected deviations come to blend into their context, with a resulting more global perception of the piece

THANK YOU

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