The Effect of Familiarity on the Time Course of Responses to Modulation in Classical Music

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ABSTRACT

This study investigated the role of familiarity and musical expertise in the time course of formation of tonal hierarchy representations in modulating Western classical melodies. Listeners at three expertise levels rated excerpts from Haydn string quartets using the concurrent probe-tone technique[1]. We compared the Western major and minor profiles[2] of the keys involved with profiles of modulating excerpts. Results indicated that musically trained participants registered all the modulations whereas nonmusicians registered primarily the principal keys. In general, participants at all three expertise levels tended to shift toward more global patterns of response to the modulations as they became more familiar with the piece.

BACKGROUND

Previous investigations show that:

(a) People form mental representations of tonal hierarchies of a musical scale at a very young age[3].

(b) Age and musical experience have little effect on the formation of mental representations of tonal hierarchies; mere exposure to an individual's culture leads to the formation of such representations, whereas training enhances it[4].

(c) Nonmusicians have a relatively sophisticated implicit understanding of tonal hierarchy and expectancies in music[5].

(d) Listeners access their mental representations of the hierarchy of notes in musical scales of their own culture when listening to culturally familiar and unfamiliar melodies[6,7].

(e) Musicians can track modulations successfully, whether with schematic chord sequences[2], continuously modulating melodies[8], or excerpts of real music[1,7].

PARTICIPANTS

Musicians

- N = 60; age range = 18 to 38 years
- musical training = more than 5 years

Moderate Musicians

- N = 60; age range = 18 to 30 years
- musical training = 1 to 5 years

Nonmusicians

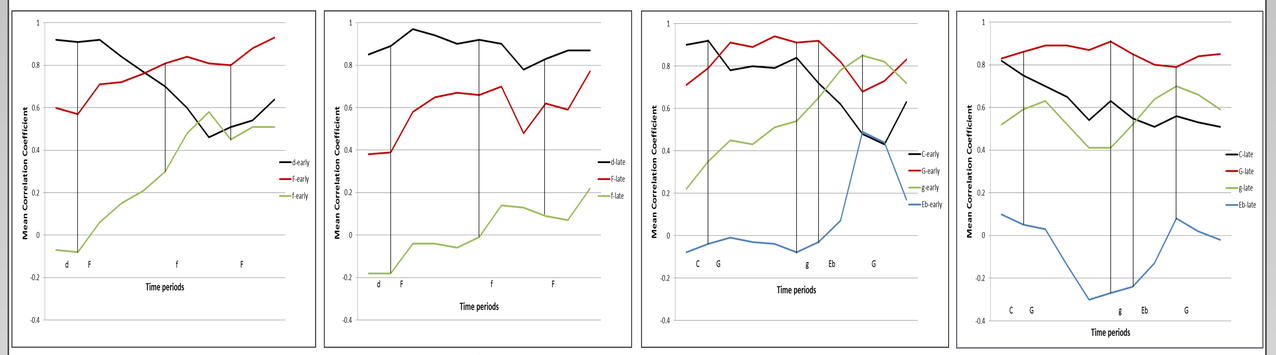
- N = 60; age range = 18 to 36 years
- musical training = less than 1 year

STIMULI

- Haydn's String Quartets, beginning of first movement:
  - (a) Op. 76, No. 2, "Quinten":
    - Duration: 1 min 47 s
    - Keys: d-minor, F-major, f-minor, F-major
  - (b) Op. 76, No. 3, "Emperor":
    - Duration: 1 min 50 s
    - Keys: C-major, G-major, g-minor, E^{b}-major, G-major
- Excerpts were taken from CD recordings by the Amadeus Quartet.
- Each excerpt was presented 12 times, forming a block, each time with a different probe.
- Participants heard the excerpt in one ear only; in the other ear, they heard a constant drone (probe tone) corresponding to one of the 12 pitch classes in the octave (C, C$^{\#}$, D, D$^{\#}$, etc.).
- Each probe tone consisted of sine waves sounded in 3 octaves (in the range of A3 to D7) spanning the middle range of the quartets.

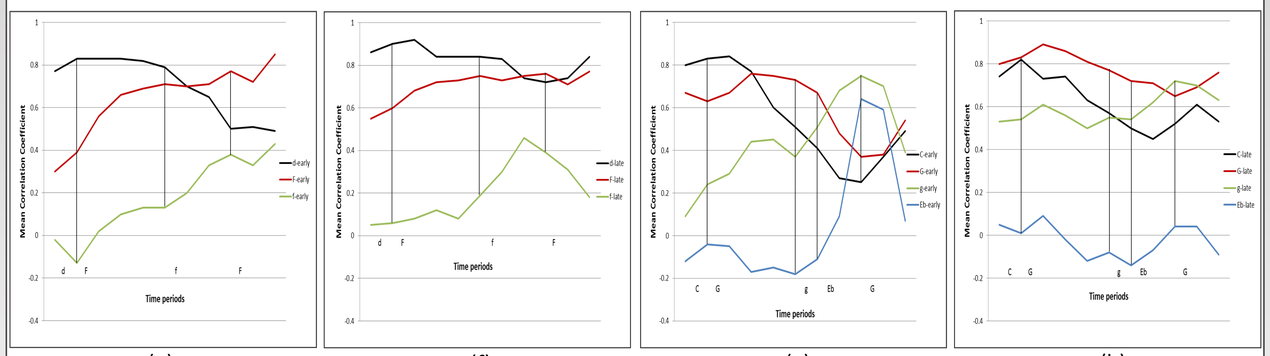
RESULTS – CORRELATIONS OF PROFILES OF MUSICIANS

Figure 1. Left panel (a, b, e, f, i, j)—"Quinten". Right panel (c, d, g, h, k, l)—"Emperor". Early trials 1-3 (a, c, e, g, i, k). Late trials 10-12 (b, d, f, h, j, l). Vertical lines indicate points of modulation. Responses were averaged and smoothed across a jumping window of time. Finally each profile generated was correlated with profiles of the corresponding major and minor keys[2].



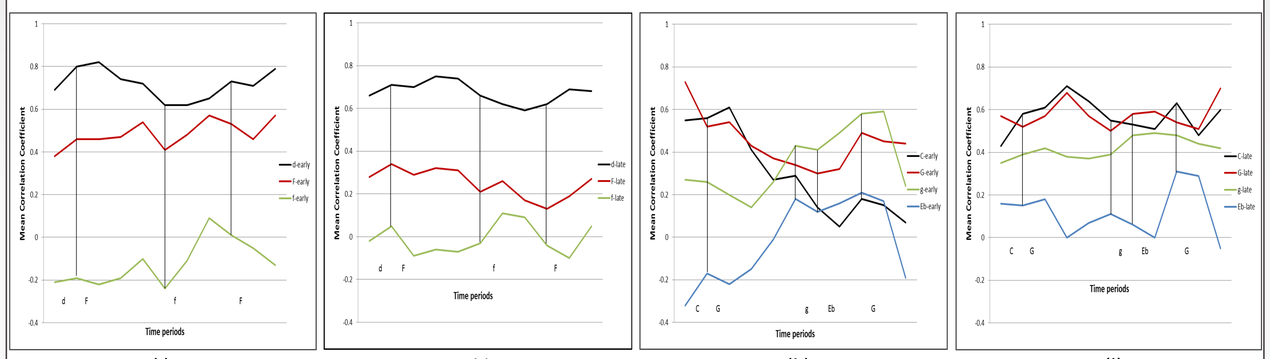
(a) (b) (c) (d)

RESULTS – CORRELATIONS OF PROFILES OF MODERATE MUSICIANS



(e) (f) (g) (h)

RESULTS – CORRELATIONS OF PROFILES OF NONMUSICIANS



(i) (j) (k) (l)

TASK

- Listeners used the mouse to rate continuously how well each tone fits the melody at every moment, on a 0 to 100 scale.
- Stimuli were presented in two blocks, each devoted to one of the quartets. Each melody was rated 12 times in each block, once for each probe. The orders of trials within blocks were organized in a Latin square, so that different participants contributed ratings of different probes at various stages of exposure to the melody in a counterbalanced order. That will allow us to look at the course of development of a tonal hierarchy profile across repeated hearings of the melody.
- We ran a 3 Musical Expertise X 3-4 Keys X 4-5 Periods ANOVA. The dependent variable was the set of correlation coefficients for each listener between standard key tonal-hierarchy profiles and profiles of ratings at points of modulation (vertical lines in the figures).

DISCUSSION AND SUMMARY

•Musically trained: Block 1: "Sharply" registered modulations in early trials, but "globally" registered modulations in late trials. Block 2: Similar to Block 1, but picked up on g-minor slowly.

•Nonmusicians: Block 1: General global perception based on d-minor for both early and late trials. Block 2: Registered modulations somewhat, but picked up on g-minor slowly in early trials; reduced differentiation among the 4 key profiles in later trials.

- In general, in agreement with previous research, it is clear that music training influenced the task wherein all three groups of participants registered the tonic key in both quartets but only trained musicians registered every modulation. Listeners reacted relatively quickly to modulations in and out of closely related keys, but with more distant keys (e.g., g-minor and E^{b}-major), their reactions were much slower. Also, as familiarity with the melodies increased, all participants shifted toward more global patterns of response to the modulations.

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