EFFECT OF AGE ON PERCEIVING TONAL MODULATIONS IN CARNĀTIC MUSIC

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31 July 2017
INDIAN CLASSICAL MUSIC

Hindustāni

Carnātic
WHY STUDY CARNĀТИC MUSIC??

- Easier to find participants in Chennai who know Carnātic music but not any other style of music
- Because of Carnātic music’s limited popularity around the world, it is easier to locate individuals unfamiliar with it
- As far as we know, there are no studies to date investigating cognitive and perceptual processing of Carnātic music (except Raman & Dowling, 2016; 2017)
  - vs. North Indian music (e.g., Bharucha & colleagues)
UNIVERSALS & COMMONALITIES

- Discrete pitches
- Octave equivalence

- Dowling’s (1978) levels of cognitive organization of tonal patterns:
  - Tonal material – 12 pitches
  - Tuning system – pitch selection

- Modal scales → Tonal hierarchy
- Melodic expectancies
CARNĀТИC MUSIC

- 350 rāgams vs. 13 Western modal scales

- C    D    Eb    F    G    Ab    Bb    C (n. minor)
- C    Db   Eb    F#   G   Ab    B    C (rāgam)

- Two types of modulations that are similar to those in Western music
MODULATIONS

- **Grahabēdham**
  - Tonal centre shifts
  - Shift in mode
  - All pitches remain same
  - E.g., C to Am
  - Controversial

- **Rāgamālikā**
  - No shift in tonal center
  - Shift in mode
  - Some pitches change
  - E.g., C to Cm
  - Popular
Types of modulation

- Grahabēdham – C to Am – new tonic
- Rāgamālikā – C to Cm – same tonic
Thamburā
CENTRAL QUESTIONS

- Do listeners perceive modulations in Carnātic music?
- Do age and music experience influence perception?

- **Nationality:** Indians, Westerners
- **Experience:** Teachers, Students
- **Modulation:** Rāgamālikā, Grahabēdham
- **Age:** Below 60 yr, Above 60 yr
- **Between-groups ANOVA:**
  2 Nationality x 2 Type of Modulation x 2 Experience x 2 Age
- **DV:** area scores (%), response times (s)
- **Task:**
  - Detect rāgam changes
  - Discriminate modulations from lures
ACCURACY: E, N, M x N
RESPONSE TIMES – M, M x N

![Graph showing response times for different groups and types of modulation.]
CONCLUSIONS

- Teachers more accurate than students
- Indians better on rāgamālikās (C to Cm)
- Westerners better on grahabēdhams (C to Am)
- Age x Experience with accuracy & RT – not supported

- Participants’ feedback on familiarity with melodies
CURRENT STUDY

Indian participants only/-

- AGE
- MUSIC EXPERIENCE
- TYPE OF MODULATION
INDIAN PARTICIPANTS

- Experience
  - Teachers (n = 34)
  - Students (n = 41)
  - Rasikās (n = 37)

- Age
  - Below 60 yr (n = 58)
  - Above 60 yr (n = 54)

- ANOVA – 2 Age x 3 Experience x 2 Type of Modulation

- DV – area scores (%), response times (s)

- Task
  - Detect rāgam changes
  - Discriminate modulations from lures
ACCURACY

3 Music Experience x 2 Age x 2 Type of Modulation

1. Music Experience**
2. Type of Modulation*
ACCURACY – Music Experience

Music Experience $\eta^2 = .13, p < .001^{**}$
ACCURACY – Type of Modulation

Type of Modulation $\eta^2 = .04, \ p = .02^*$
Same tonic = 45 shifts, 42 lures
Music Experience $\eta^2 = .18$, $p = .002^*$

New tonic = 46 shifts, 42 lures
Music Experience $\eta^2 = .12$, $p = .06^{tr}$
RESPONSE TIME

3 Music Experience x 2 Age x 2 Type of Modulation

1. Music Experience*
2. Type of Modulation**
3. Type of Modulation x Age*
RT – Music Experience

Music Experience $\eta^2 = .008, \ p = .04^*$
RT – Type of Modulation

Type of Modulation $\eta^2 = .85$, $p < .001^{**}$
RT – Type of Modulation x Age

Age x Type of Modulation $\eta^2 = .009, p = .007^*$
RESPONSE TIME – Exp x Age

Same tonic = 45 shifts
Age $\eta^2 = .19$, $p < .001^{**}$

New tonic = 46 shifts
Music Experience $\eta^2 = .12$, $p = .07^{*}$
CONCLUSIONS

- Teachers – accurate with both modulations
- Teachers – faster with both modulations
- Better with rāgamālikās (C to Cm)
- Age x Modulation with RT
- Only with rāgamālikās
- Age x Experience with accuracy & RT – not supported
CONCLUSIONS

- Experience improves accuracy & reduces errors; lowers RT
- Age and prior knowledge
  - Familiarity vs. Unfamiliarity
- Participants’ feedback & cues
  - Culture-specific
  - Veridical knowledge
  - Schematic knowledge
  - Surface-level
FUTURE DIRECTION

- Unfamiliar stimuli
- Western aficionados
- Include other music systems
QUESTIONS???
THANK YOU

- Madhurai G. S. Mani (my Carnātic guru)
- Sirisha Bhadriraju, T.V. Raghuraman, Ashwin Ramesh, Valerie Richardson (data entry)
- My family (recruiting participants in Chennai)
- All my wonderful participants
WHY CROSS-CULTURAL RESEARCH??

- To study music as a human phenomenon.
- To identify universal as well as culture-specific aspects of music processing across cultures.
- Processing of musical features, such as melody, rhythm, and harmony, are to a large extent culturally determined (Cross, 2009).
- To understand the role of acculturation.
  - Tonal hierarchy and expectations are universal traits of music.
- Cross-cultural studies need two components
  - cross-cultural participants
  - cross-cultural music
PRIOR RESEARCH

- Janata, Birk, Tillmann, & Bharucha (2003)
- Tonal pop-out

[Diagram]

- [Link](http://atonal.ucdavis.edu/publications/papers/science.html)
- fMRI
- Brain is tracking tonal space
ERP studies on modulations

Koelsch, Gunter, Schröger, & Friederici (2003)
CROSS-CULTURAL
THE CUE-REDUNDANCY MODEL

- Balkwill & Thompson (1999)

Diagram:

- Western music
- Carnatic music
- Auditory cues shared by all music
- Intended emotion
- Familiar tonal system
- Unfamiliar tonal system
- Culture specific cues (left)
- Culture specific cues (right)
Castellano, Bharucha, & Krumhansl (1984)
- Hindusthāni music
- Indian and western participants
- Rate how well probe fit
- Psychophysical cues

Curtis & Bharucha (2009)
- Hindusthāni music
- Indian and western participants
- Indicate whether test tone occurred
- Psychophysical + Schematic
7-note Grahābēdham

Shankarābaranam - Ionian

Karaharapriyā - Dorian
5-note Grahabēdham

Mōhanam

Madhyamāvathī
Hindōlam
Suddha Sāvēri
Suddha dhanyāsi
Schubert String Quartet in A minor
~example of Rāgamālikā

http://www.youtube.com/watch?v=tEk_ARGPD
BM&feature=results_main&playnext=1&list=PLFAE3BCF376CC8A16
HYPOTHESES

- Rāgamālikā vs. Grahabēdham
- Students and Teachers vs. Rasikās
- Older – slower
- Age x Music Experience
  - Age will impact response times of older teachers but not accuracy