EFFECT OF AGE ON PERCEIVING TONAL MODULATIONS IN CARNĀTIC MUSIC

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INDIAN CLASSICAL MUSIC

Hindustāni

Carnātic

WHY STUDY CARNĀTIC 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)

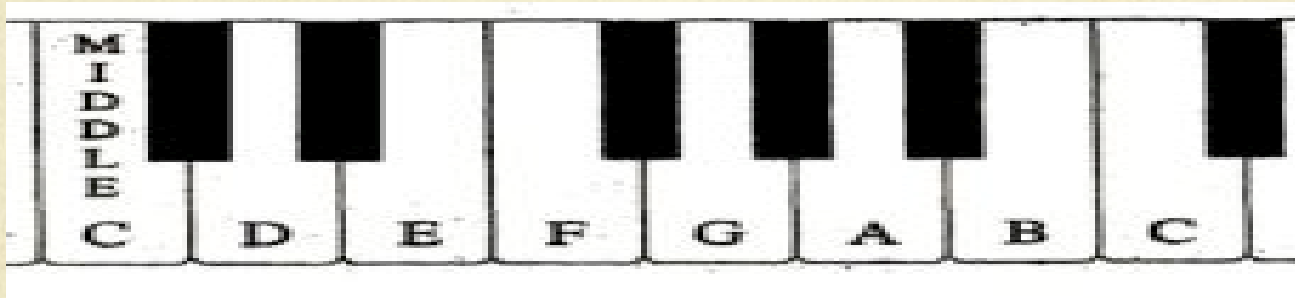   ○ vs. North Indian music (e.g., Bharucha & colleagues)

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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

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CARNĀTIC 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
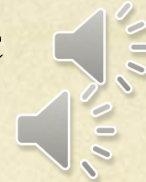- All pitches remain same
- E.g., C to Am
- Controversial

Rāgamālikā

- No shift in tonal center
- Shift in mode
- Some pitches change
- E.g., C to Cm
- Popular

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- Types of modulation
  - Grahabēdham – C to Am – new tonic
  - Rāgamālikā – C to Cm – same tonic

Sankarābharanam

Kalyāni

Sankarābharanam modulated to Kalyāni

Thamburā

CENTRAL QUESTIONS

○ Do listeners perceive modulations in Carnātic music?

○ Do age and music experience influence perception?

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- **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

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ACCURACY: E, N, M x N
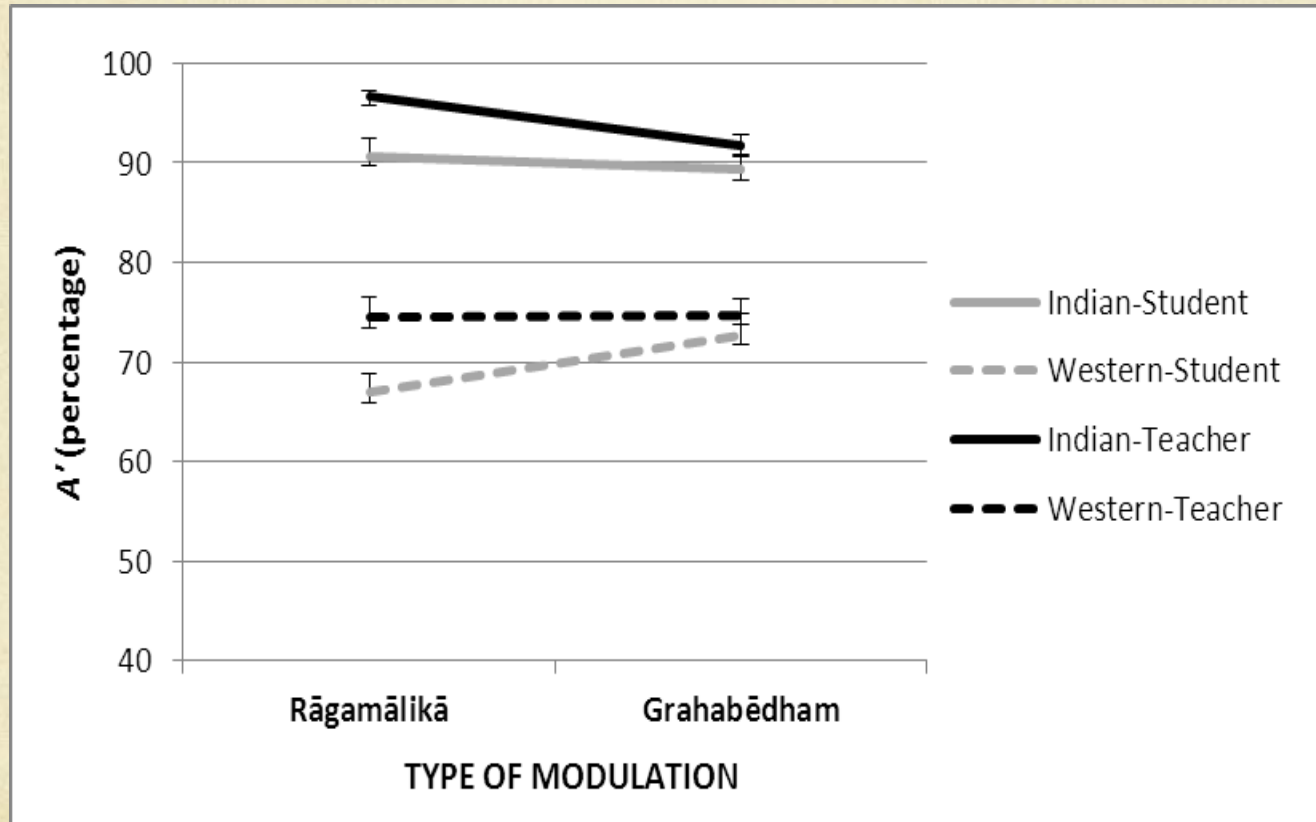
RESPONSE TIMES – M, M x N

12
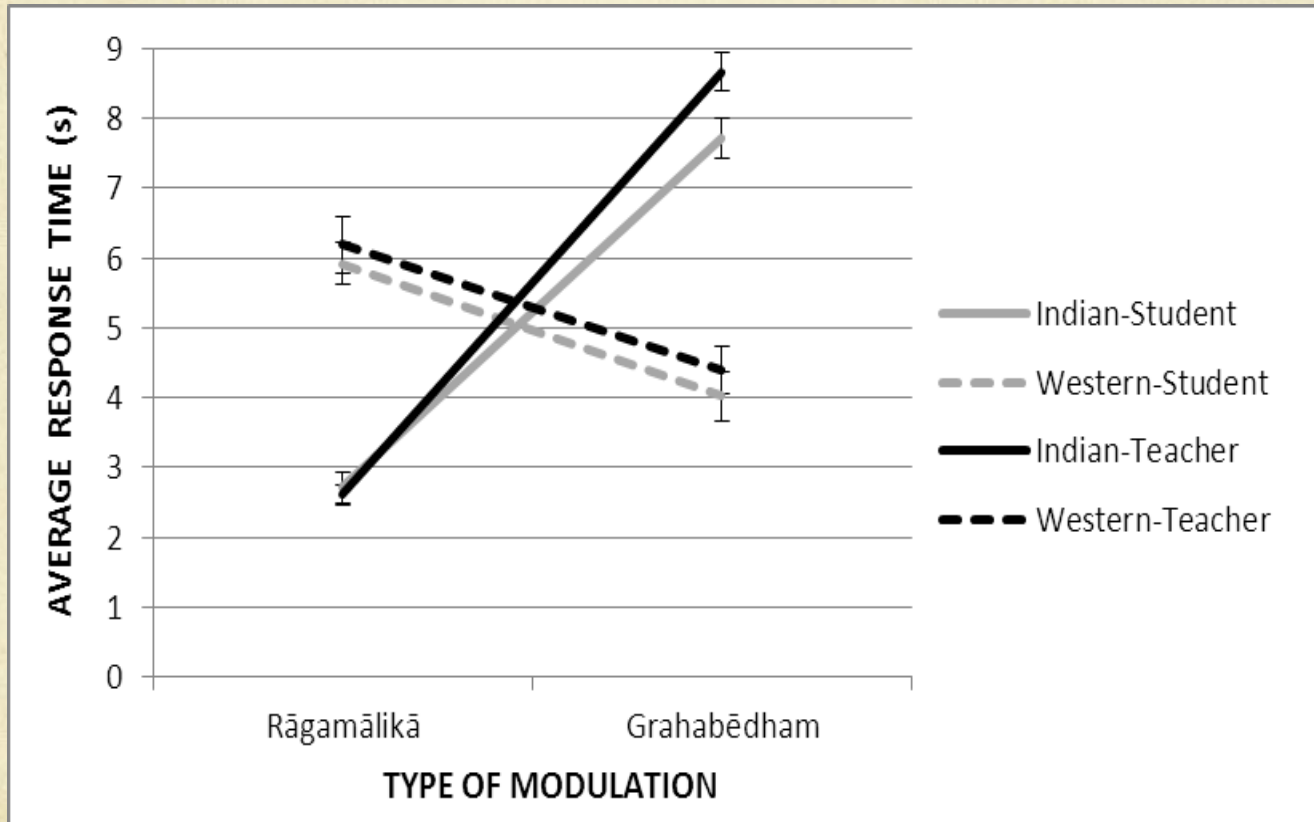
CONCLUSIONS

- 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

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CURRENT STUDY

Indian participants only/-

- AGE

- MUSIC EXPERIENCE

- TYPE OF MODULATION

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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
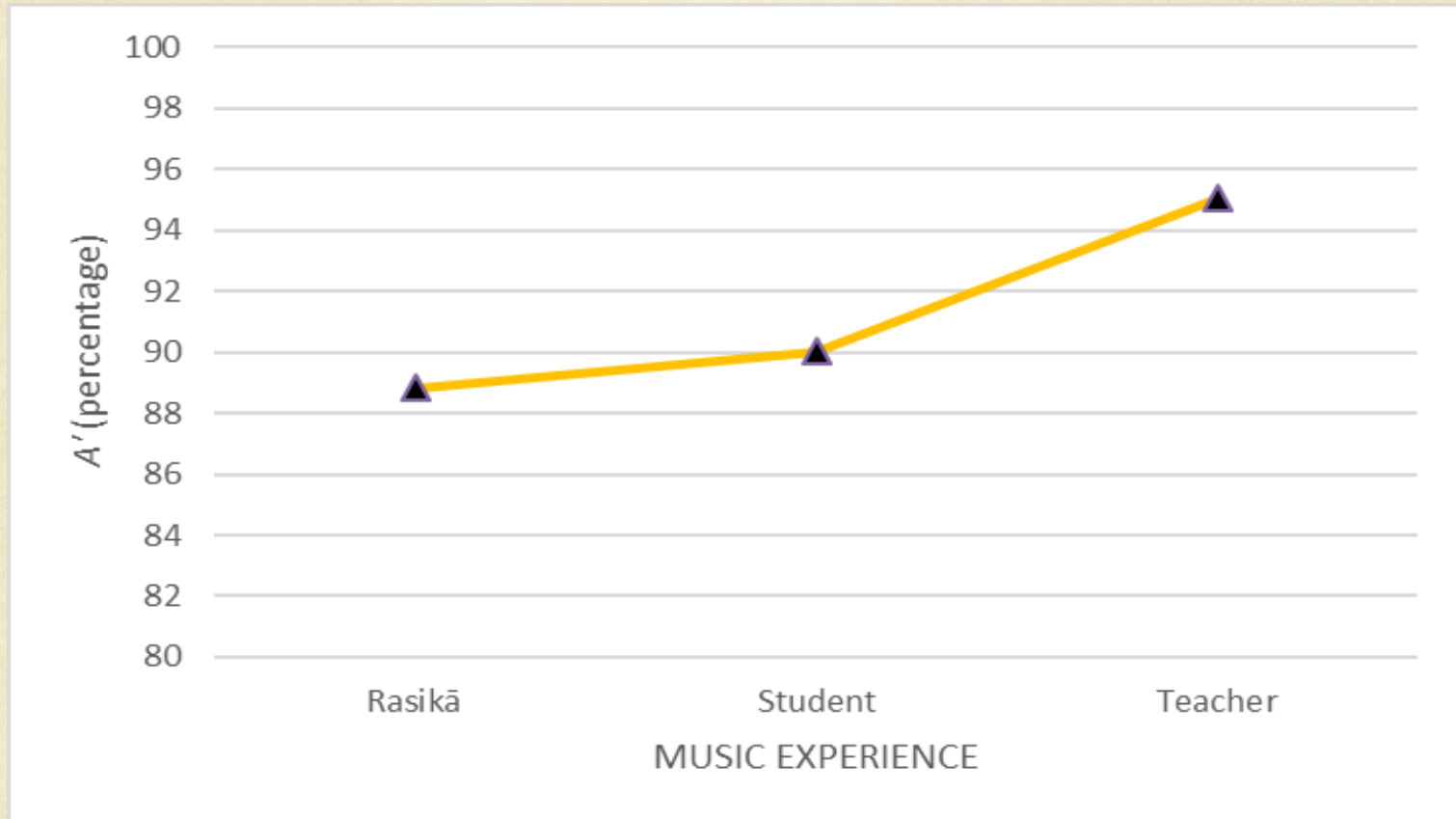 - Discriminate modulations from lures

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ACCURACY

3 Music Experience x 2 Age x 2 Type of Modulation

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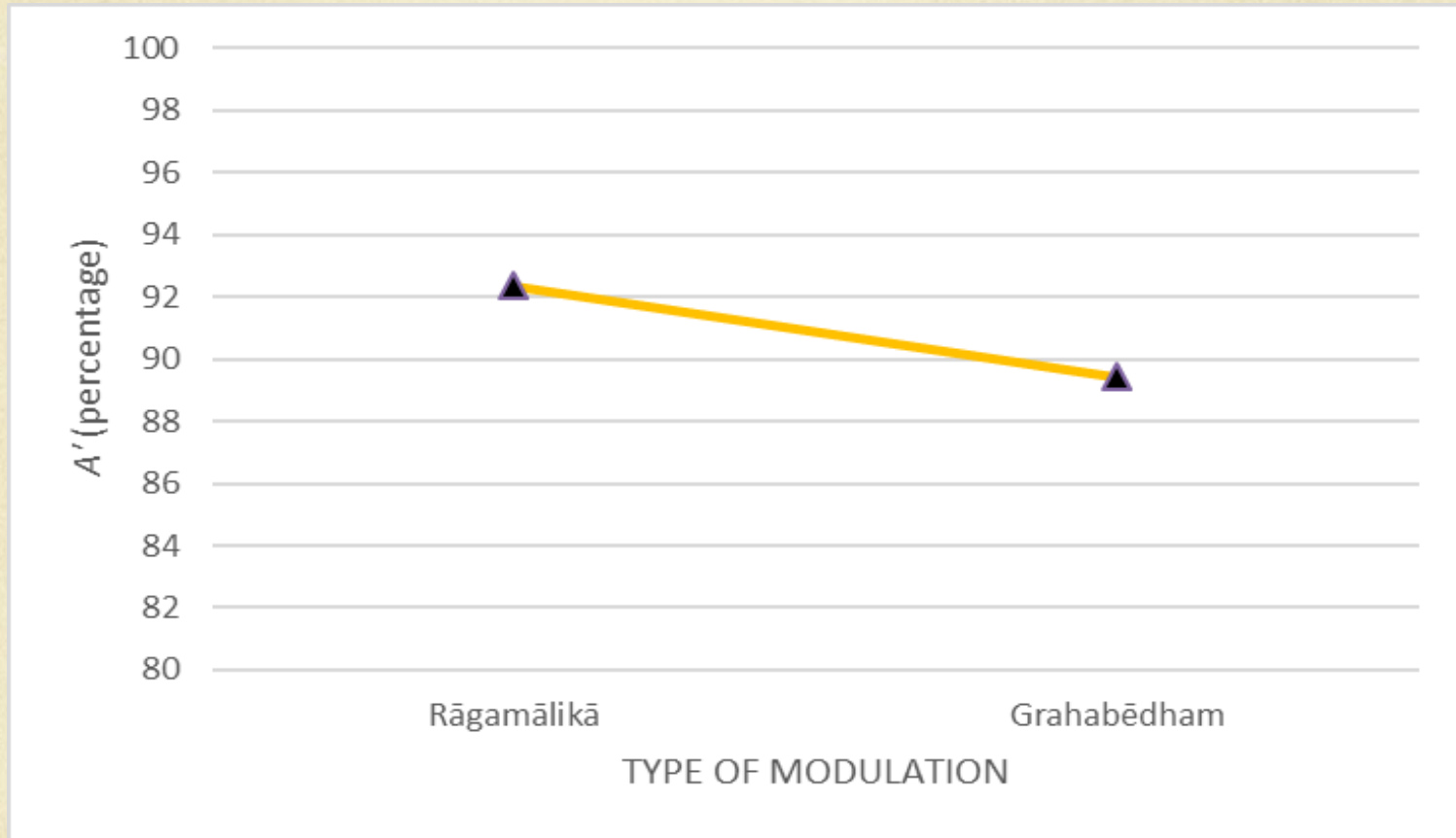2. Type of Modulation*

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ACCURACY – Music Experience
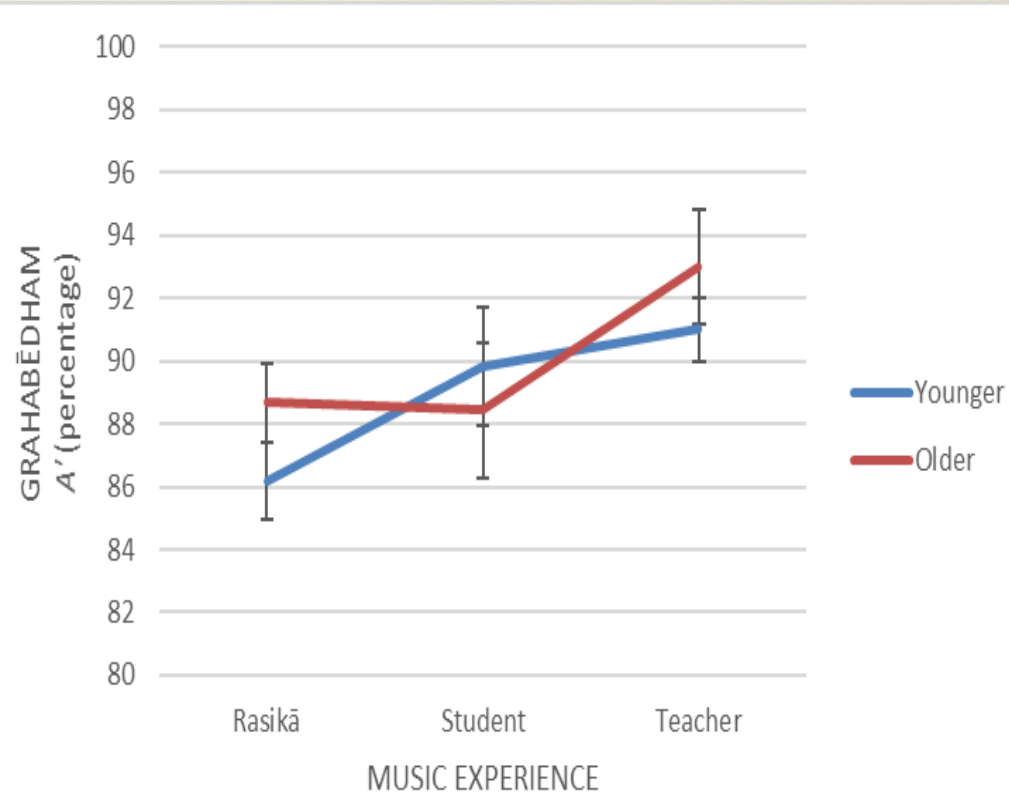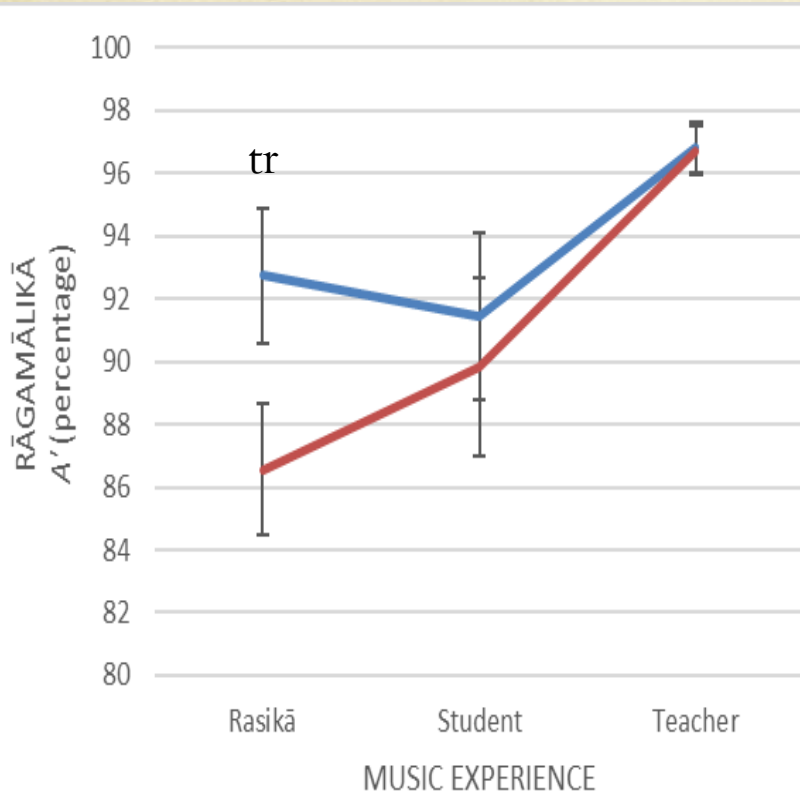

Music Experience $\eta^2 = .13$, $p < .001**$

ACCURACY – Type of Modulation

Type of Modulation $\eta^2 = .04$, $p = .02$*

ACCURACY – Exp x Age

Same tonic = 45 shifts, 42 lures
Music Experience η^2 = .18, p = .002*

New tonic = 46 shifts, 42 lures
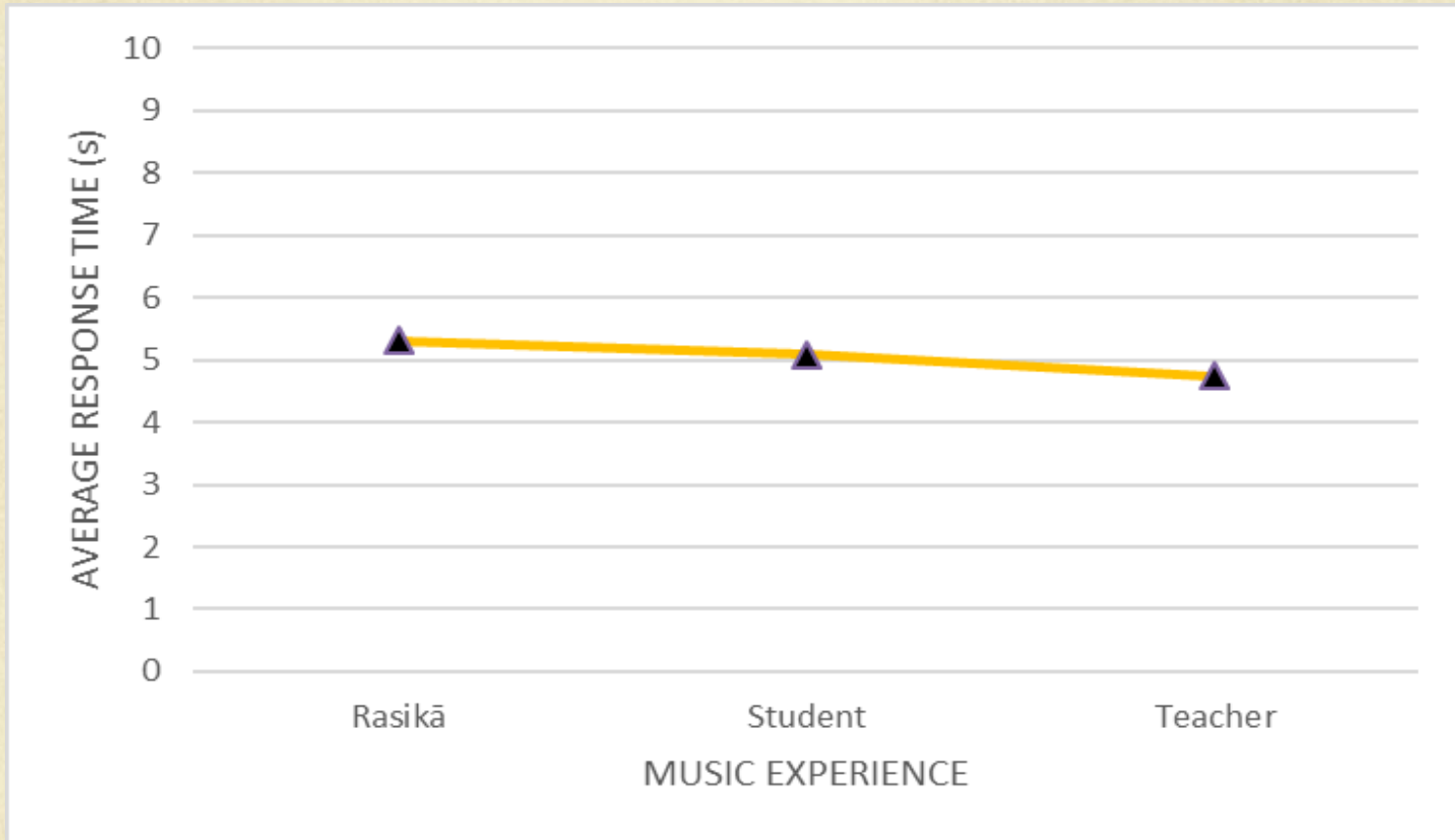Music Experience η^2 = .12, p = .06tr

RESPONSE TIME

3 Music Experience x 2 Age x 2 Type of Modulation

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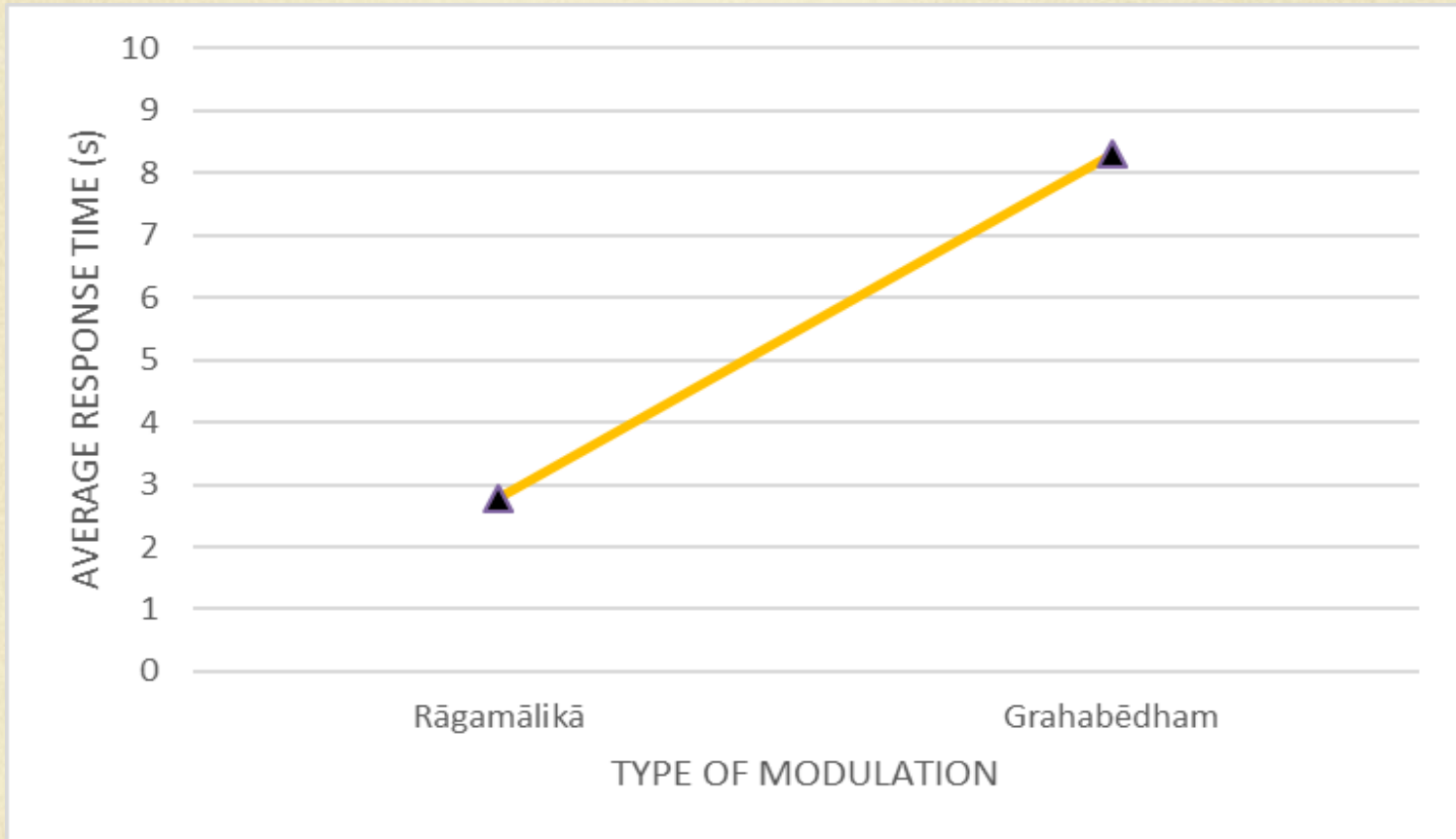2. Type of Modulation**
3. Type of Modulation x Age*

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RT – Music Experience
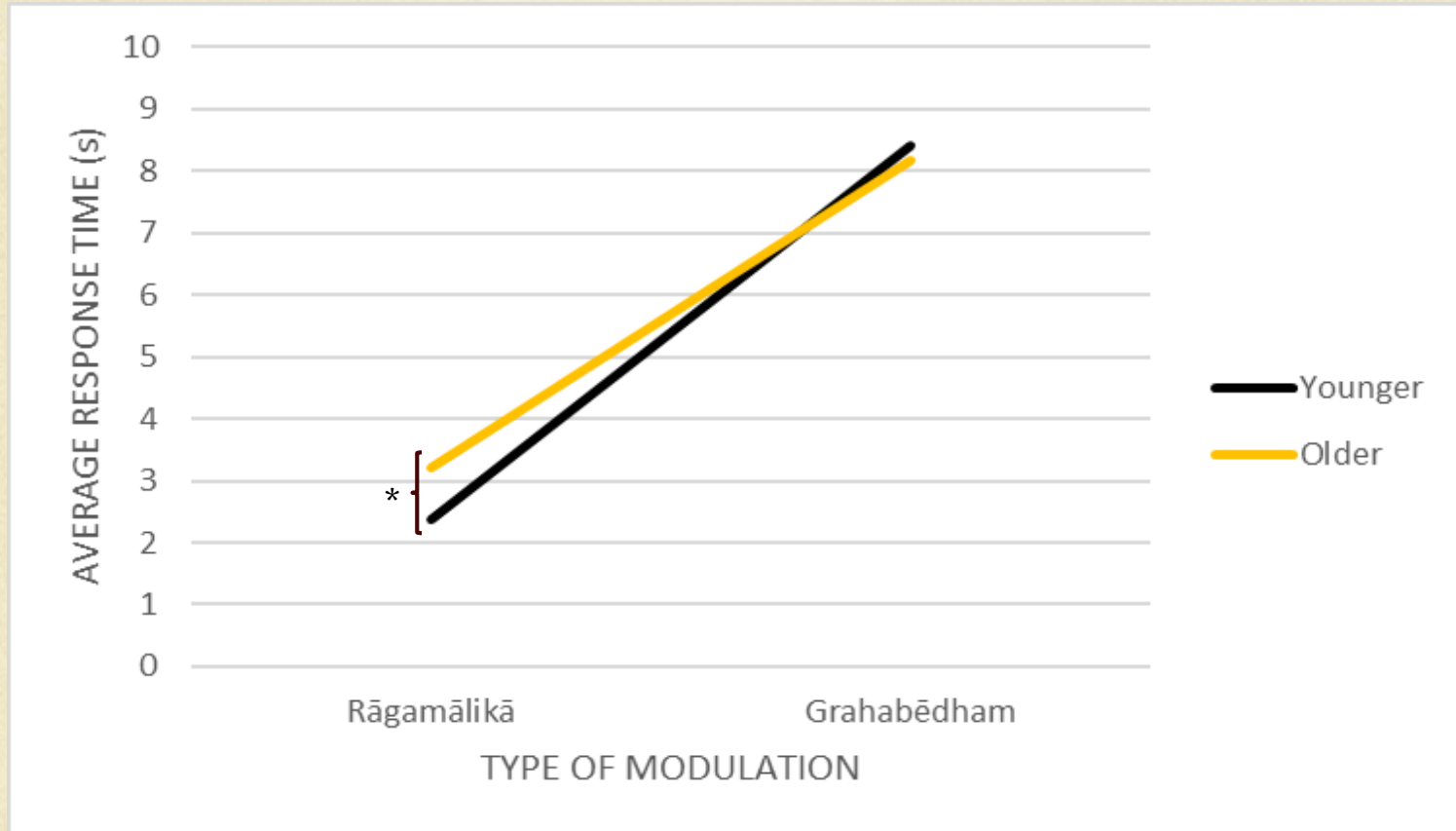

Music Experience $\eta^2 = .008$, $p = .04*$

RT – Type of Modulation
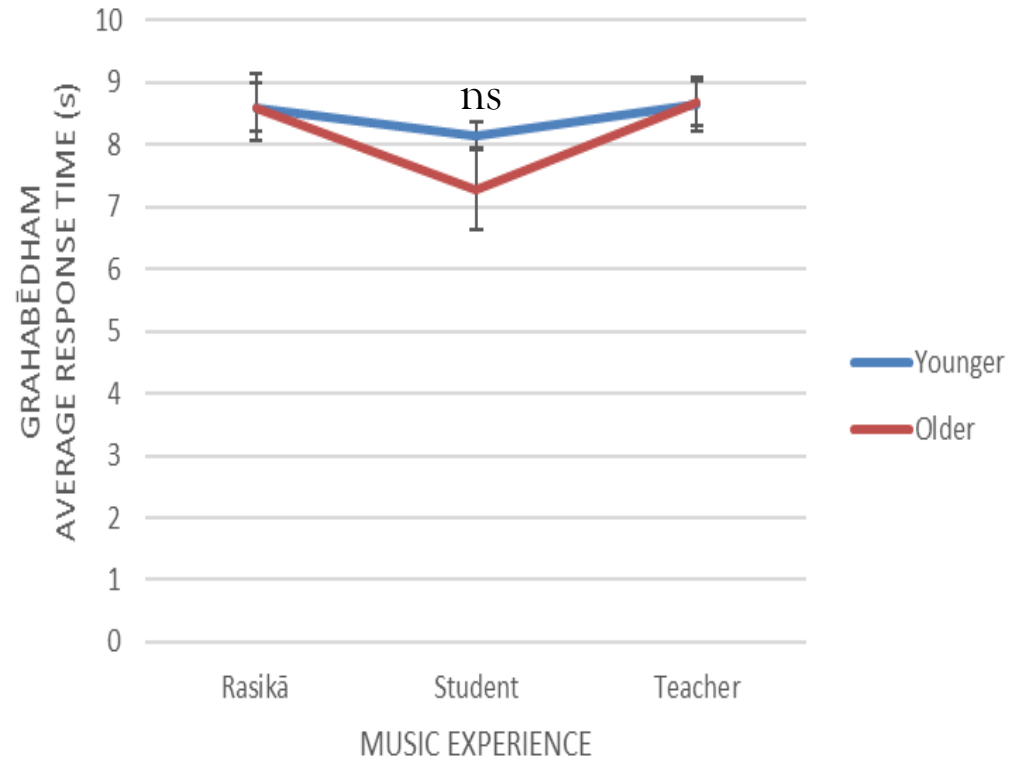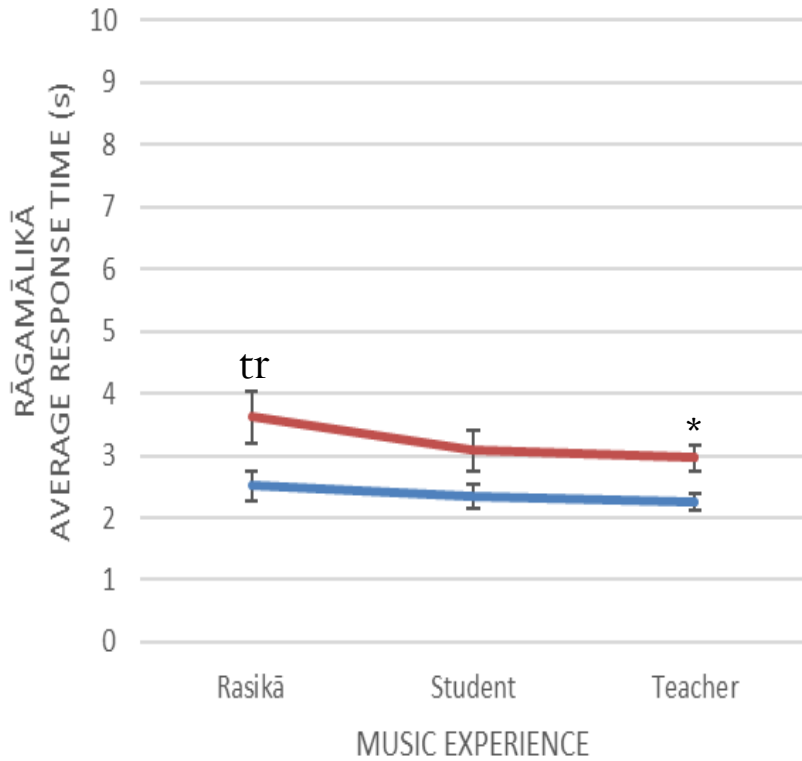

Type of Modulation η^2 = .85, p < .001**

RT – Type of Modulation x Age

Age x Type of Modulation η^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 $\eta^2 = .12$, $p = .07$tr

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

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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

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FUTURE DIRECTION

- Unfamiliar stimuli

- Western aficionados

- Include other music systems

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QUESTIONS???

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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

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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

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PRIOR RESEARCH

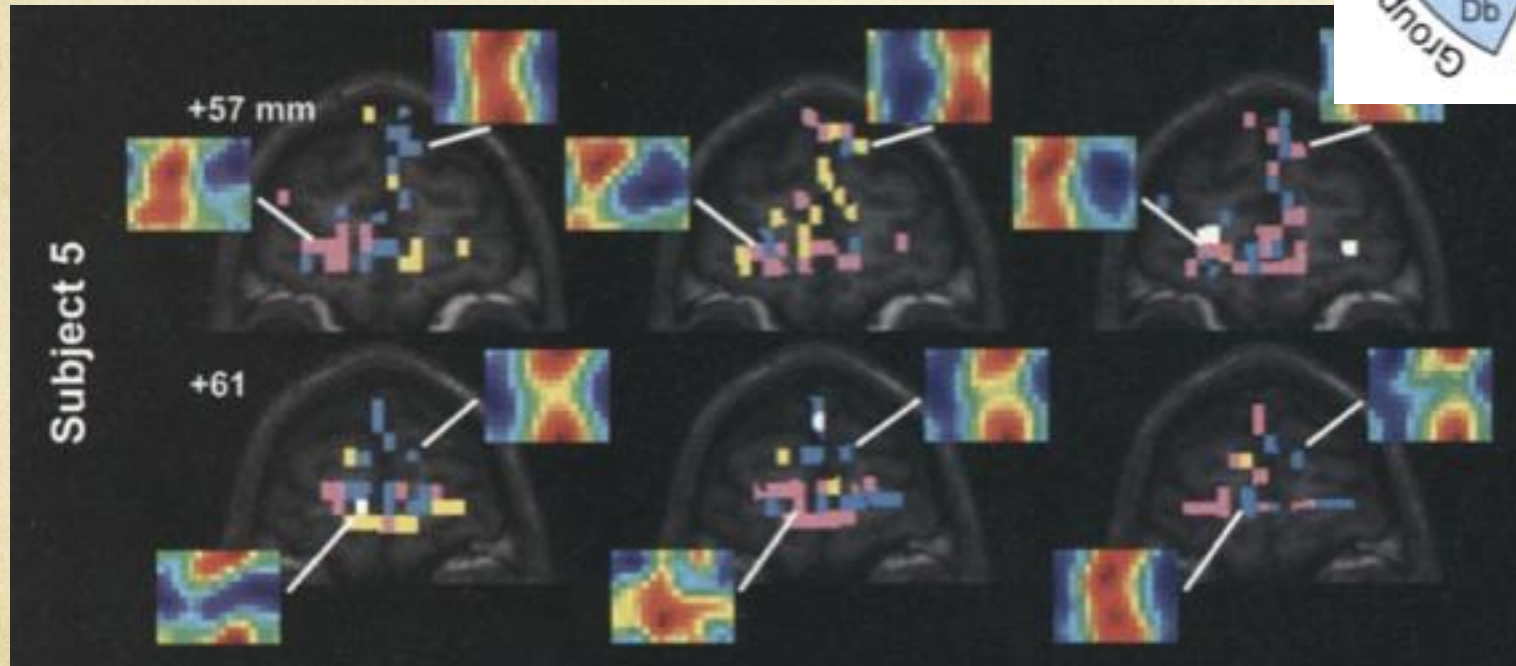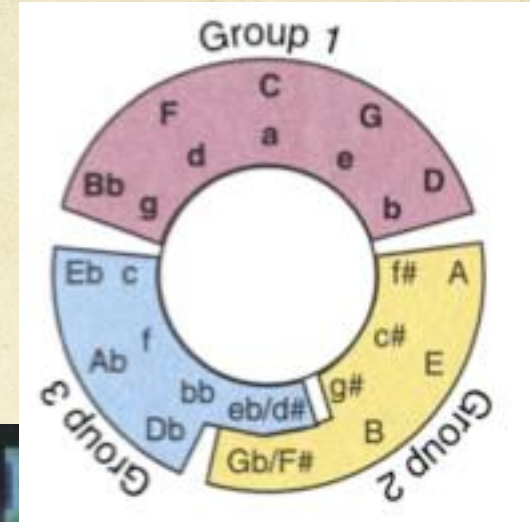○ Janata, Birk, Tillmann, & Bharucha (2003)

○ Tonal pop-out

○ http://atonal.ucdavis.edu/publications/papers/science.html

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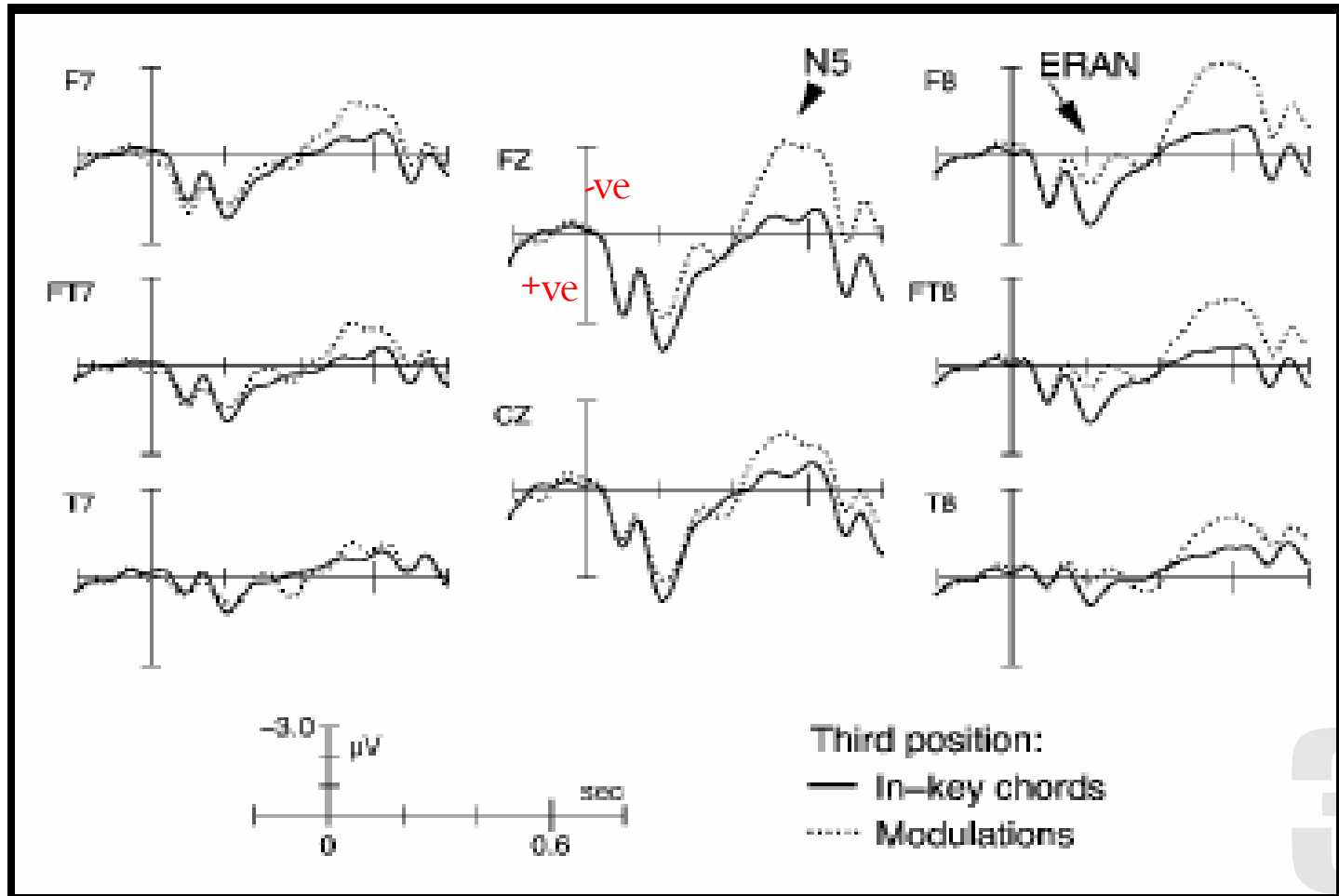- Janata, Birk, Van Horn, Leman, Tillmann, & Bharucha (2002)

- fMRI

- Brain is tracking tonal space

- o ERP studies on modulations

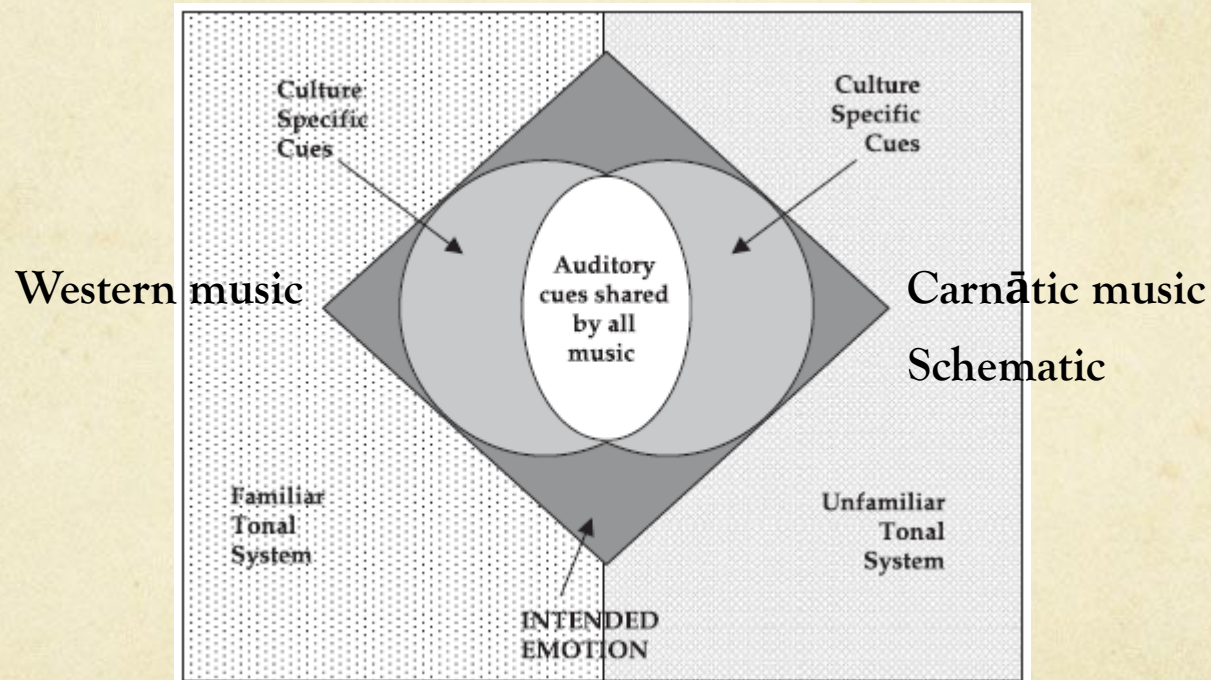- o Koelsch, Gunter, Schröger, & Friederici (2003)

CROSS-CULTURAL

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THE CUE-REDUNDANCY MODEL
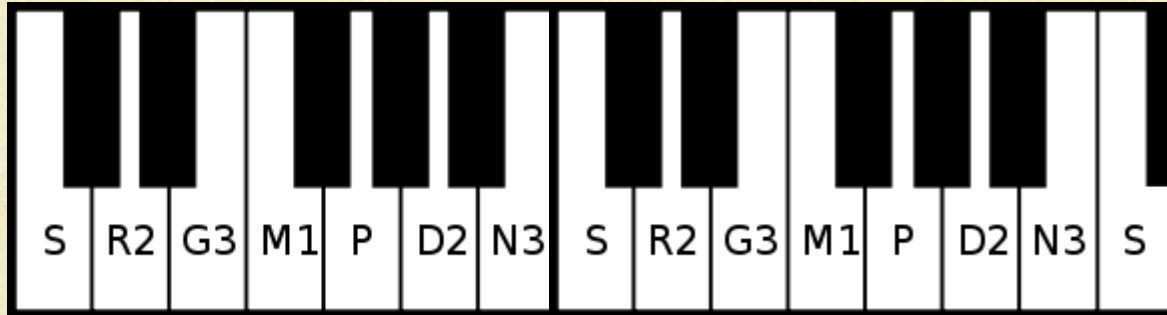
○ Balkwill & Thompson (1999)

- 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
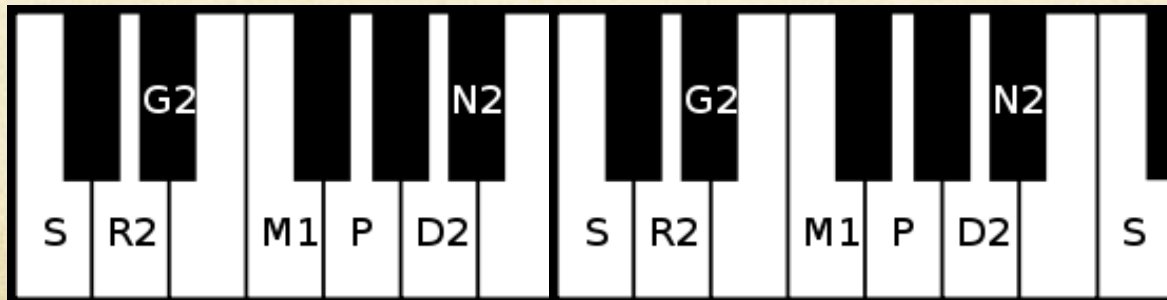 - Psychophysical + Schematic
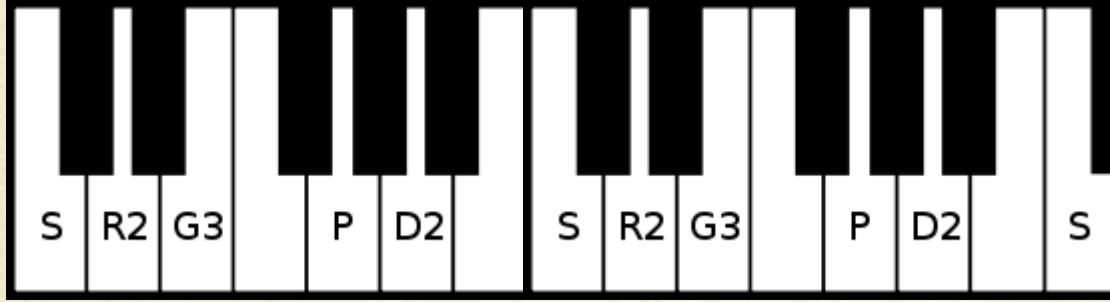
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7-note Grahabēdham

Shankarābaranam - Ionian

| S | R2 | G3 | M1 | P | D2 | N3 | S | R2 | G3 | M1 | P | D2 | N3 | S |

Karaharapriyā - Dorian

| S | R2 | G2 | M1 | P | D2 | N2 | S | R2 | G2 | M1 | P | D2 | N2 | S |

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5-note Grahabēdham

Mōhanam

Madhyamāvathi
Hindōlam
Suddha Sāvēri
Suddha dhanyāsi

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Schubert String Quartet in A minor
~example of Rāgamālikā

http://www.youtube.com/watch?v=tEk_ARGPD
BM&feature=results_main&playnext=1&list=P
LFAE3BCF376CC8A16

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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