Listeners' tolerance when listening to melodic performances

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Does Marilyn sing in tune?

Musical errors
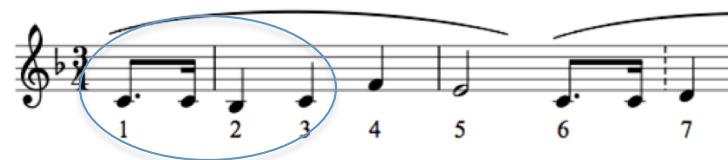
Contour error
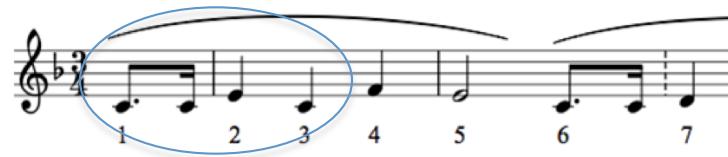
Interval error

Tonality error

Musical errors

166 performances

http://sldr.org/sldr000774/en

Computer assisted method
(Larrouy-Maestri & Morsomme, 2013)

3 criteria

Judges

1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9
Out of tune   In tune
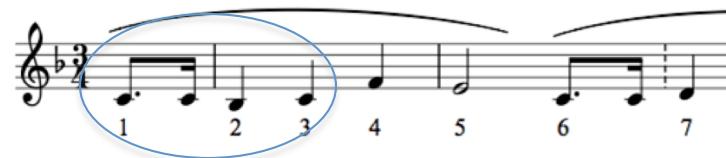
Musical errors

Contour error

Interval error

Tonality error

Larrouy-Maestri, P., Lévêque, Y., Schön, D., Giovanni, A., & Morsomme, D. (2013). The evaluation of singing voice accuracy: A comparison between subjective and objective methods. *Journal of Voice*.

Musical errors

Contour error
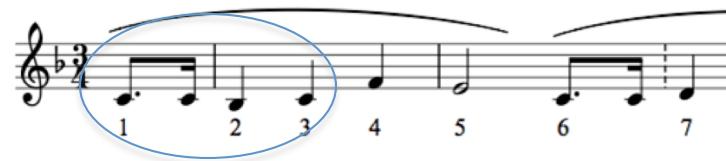
Interval error

Tonality error

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Musical errors

- Intervals are important in the definition of vocal pitch accuracy in a melodic context

- When you are an experts, you pay attention to interval deviation and number of modulations

- But … **tolerance?**

Tolerance

- Pitch discrimination (e.g., http://www.musicianbrain.com/pitchtest/)

- In a melodic context
  - Semitone (100 cents) Berkowska & Dalla Bella, 2009 ; Dalla Bella et al., 2007, 2009a, 2009b ; Pfordresher & al., 2007, 2009, 2010
  - Quartertone (50 cents) Hutchins & Peretz; 2012 ; Hutchins, Roquet, & Peretz, 2012 ; Pfordresher & Mantell, 2014

- Tolerance of layman listeners for non-familiar melodies
  - Much less than a quartertone !
  - Whatever the type of error, the place and size of the interval

- But … effect of **familiarity?** **Yes** (Kinney, 2009)
  No (Warrier & Zatorre, 2002)

- Effect of **expertise?** **Yes** (most of the literature)
  No (Larrouy-Maestri et al., under revision)

Tolerance: Participants

	Musicians	Non Musicians
n	30	30
Gender	5 women	5 women
Age	$M = 41$ ($SD = 11.85$)	$M = 41$ ($SD = 12$)
Instrument	20 chords 11 wind 4 percussions 5 singers	no history of choral singing no formal musical training (max 2 years and no practice during the past 5 years)
Years of training	$M = 30.7$ ($SD = 12.32$)	
Starting	$M = 8.8$ ($SD = 4.63$)	
Audiometry		hearing threshold below 20 dB HL
Production task		ability to perform Happy Birthday with respect to appropriate melodic contour
MBEA (Peretz et al., 2003)		no deficit in music perception

Tolerance: Material

- ## Familiar and Non-Familiar melodies

- ## Online questionnaire

  - 399 participants from 13 to 70 years old (*M* = 29.81)
  - Familiarity ratings
    - $t(398) = 20.92$, $p < .001$
   - No effect of expertise on the ratings ($p > .05$)

Tolerance: Procedure

Methods of limits
(Van Besouw, Brereton, & Howard, 2008)

Run 1 Run 2 Run 3 ... Run 10

(Deviation, in cents)
+ 60
+ 50
+ 40
+ 30
+ 20
+ 10

- 10
- 20
- 30
- 40
- 50
- 60

Two times
Test-retest paradigm
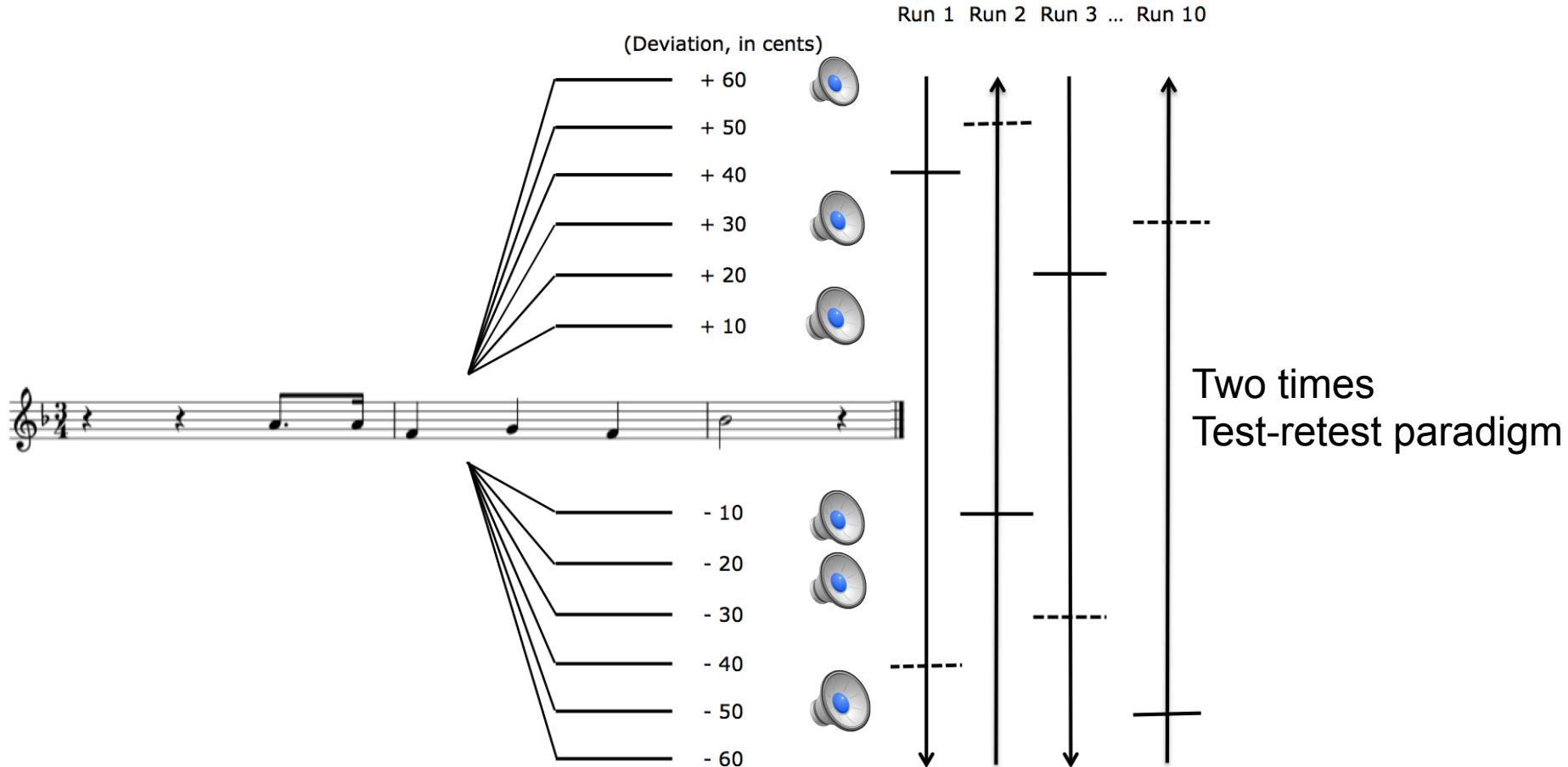
Tolerance: Test-retest

- ## Highly significant correlation ($r(60) = .91$, $p < .001$)
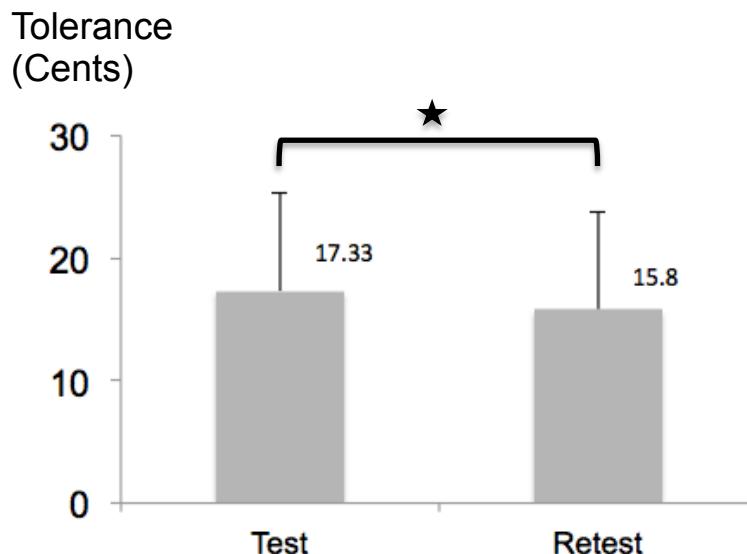
Tolerance
(Cents)

- No effect of the direction of the deviation (i.e., enlargement vs. compression) $t(59) = .-96$, $p = .34$

- No effect of expertise ($p = .08$) or familiarity ($p = .71$) or interaction ($p = .65$) on the evolution test-retest

- ## Training effect ($t(59) = 2.92$, $p = .005$)

Tolerance: Effect of expertise and familiarity
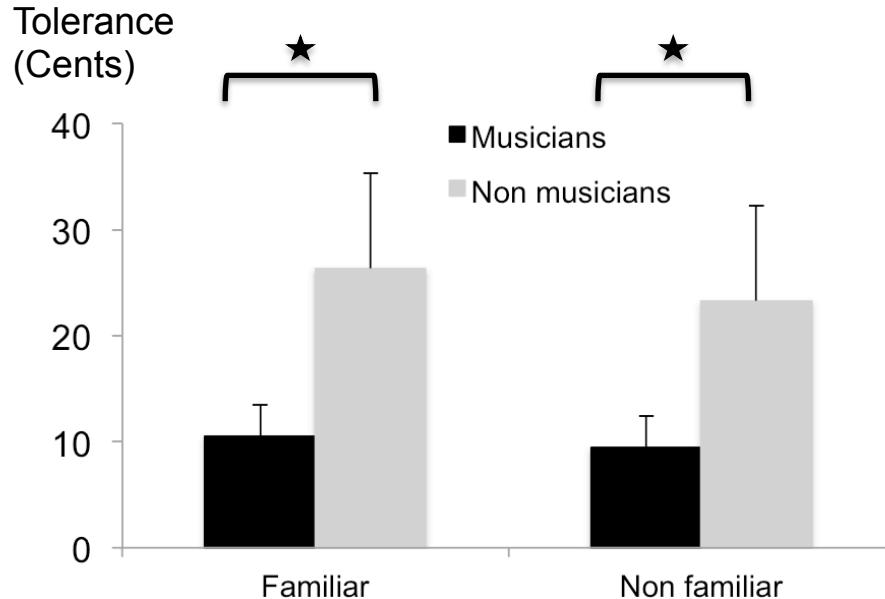
- Effect of expertise (F(1, 116) = 139.11, p < .001, η² = .54)
- No effect of familiarity (F(1, 116) = 2.74, p = .10)
- No interaction (F(1, 116) = .60, p = .44)

Tolerance: Effect of expertise and familiarity

- Low tolerance of all listeners when listening to melodies slightly out of tune (less than a quarter tone)

- Highly significant expertise effect, even for a familiar song well known by the participants (i.e., Happy Birthday)

- But … **perceptual limit of musicians?**

Tolerance: The case of musicians
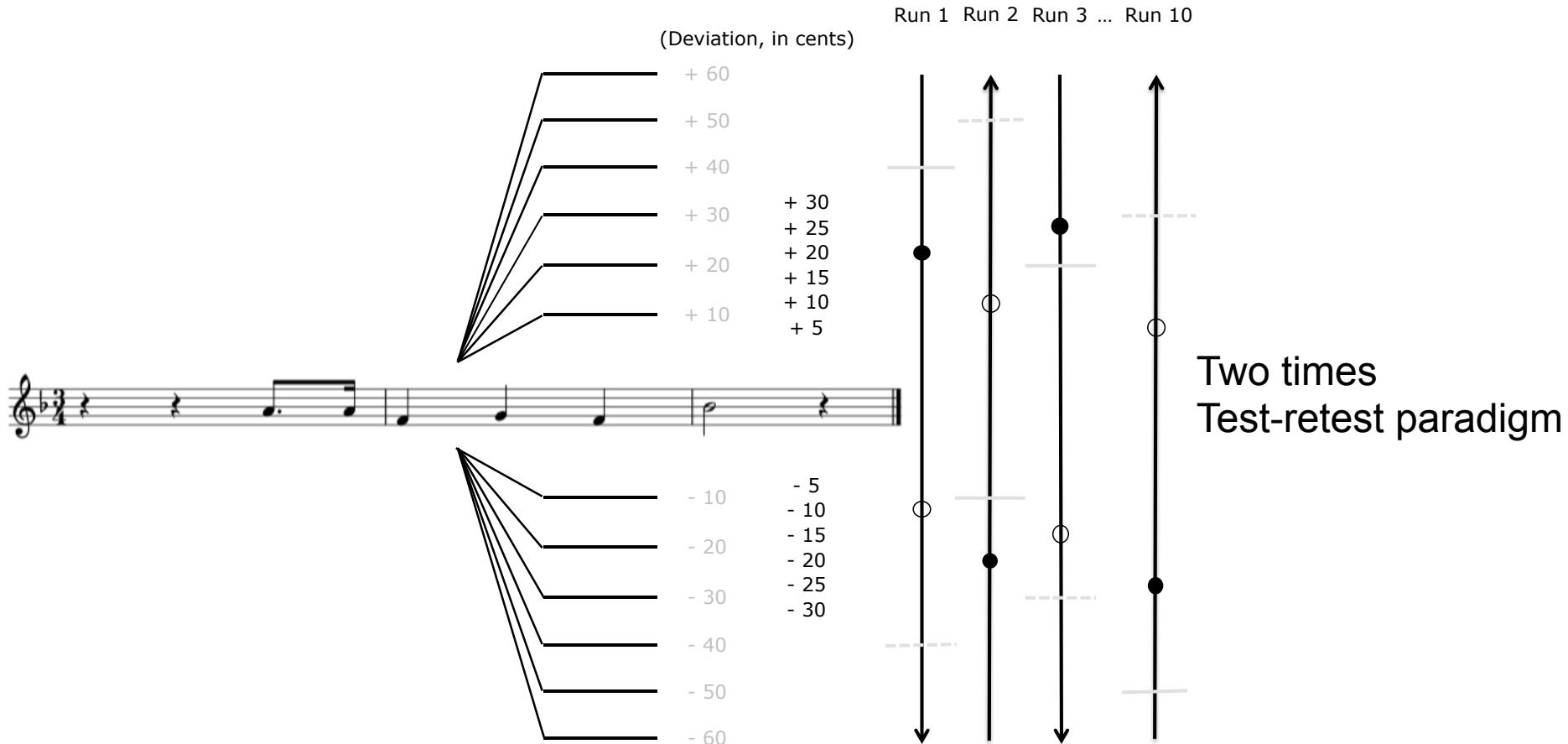
Tolerance: The case of musicians

	Musicians
n	30
Gender	11 women
Age	M = 42 (SD = 13.09)
Instrument	Chords, winds, percussions, singers
Years of training	M = 34.63 (SD = 13.27)
Starting	M = 7.45 (SD = 4.38)

- Test retest
  - Highly significant correlation (r(30) = .86, p < .001)
  - No training effect (t(29) = .91, p = .39)

Tolerance: The case of musicians
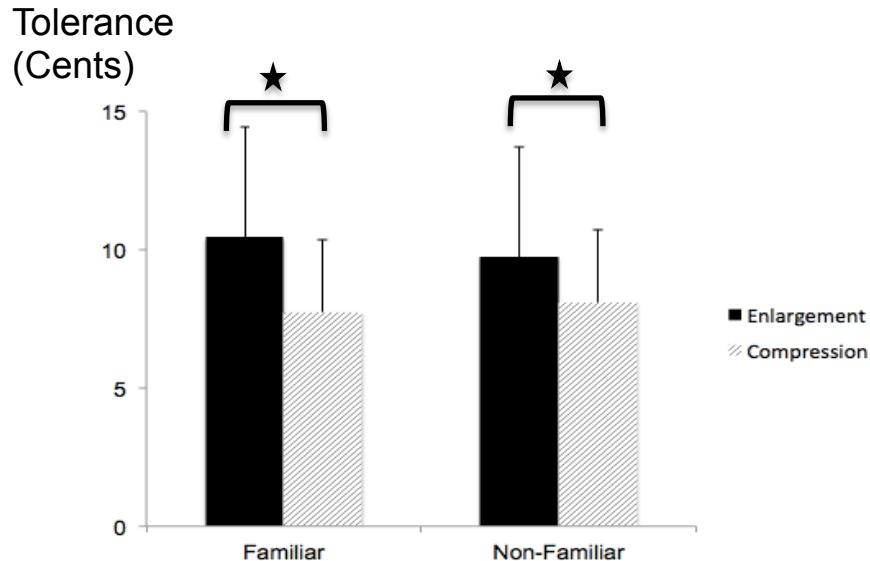
- No effect of familiarity ($F(1, 116) = .25$, $p = .62$)
- Effect of the direction of the deviation ($F(1, 116) = 10.64$, $p < .01$, $\eta^2 = .08$)
- No interaction ($F(1, 116) = .77$, $p = .38$)

Tolerance: Conclusions

- Consistency when categorizing melodies
- Whatever the familiarity of the melody and the training
  - ➔ Categorical perception process?
- Low tolerance, particularly for music experts
- Limit around 10 cents, even with very precise material
  - ➔ What leads to precise melodic representations?

➔ **Pertinent material to investigate perception process and similarities with prosodic perception**

➔ **Opportunity to refine objective tools for the evaluation of singer pitch accuracy**

# Does Marilyn sing in tune?

Thank you for your attention!

References

- Berkowska, M., & Dalla Bella, S. (2009). Reducing linguistic information enhances singing proficiency in occasional singers. Annals of the New York Academy of Sciences, 1169, 108-111.

- Dalla Bella, S., Giguère, J. -F., & Peretz, I. (2007). Singing proficiency in the general population. *The Journal of the Acoustical Society of America, 121*(2), 1182-1189.

- Dalla Bella, S., & Berkowska, M. (2009a). Singing Proficiency in the Majority. *Annals of the New York Academy of Sciences, 1169*(1), 99-107.

- Dalla Bella, S., Giguère, J.-F., & Peretz, I. (2009b). Singing in congenital amusia. The Journal of the Acoustical Society of America, 126(1), 414.

- Hutchins, S., & Peretz, I. (2012). A frog in your throat or in your ear? Searching for the causes of poor singing. *Journal of Experimental Psychology: General, 141*, 76–97.

- Hutchins, S., Roquet, C., & Peretz, I. (2012). The Vocal Generosity Effect: How Bad Can Your Singing Be? Music Perception, 30(2), 147-159.

- Kinney, D. W. (2009). Internal Consistency of Performance Evaluations as a Function of Music Expertise and Excerpt Familiarity. Journal of Research in Music Education, 56(4), 322-337.

- Larrouy-Maestri, P., Lévêque, Y., Schön, D., Giovanni, A., & Morsomme, D. (2013). The evaluation of singing voice accuracy: A comparison between subjective and objective methods. *Journal of Voice*, 27(2), 259.e251-e255.

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References

- Larrouy-Maestri, P., & Morsomme, D. (2014). Criteria and tools for objectively analysing the vocal accuracy of a popular song. Logopedics, phoniatrics, vocology, 39(1), 11-18.

- Peretz, I., Champod, A.-S., & Hyde, K. (2003). Varieties of Musical Disorders : The Montreal Battery of Evaluation of Amusia. New York Academy of Siences, 999, 58-75.

- Pfordresher, P. Q., & Brown, S. (2007). Poor-pitch singing in the absence of "tone deafness". *Music Perception, 25*(2), 95-115.

- Pfordresher, P. Q., & Brown, S. (2009). Enhanced production and perception of musical pitch in tone language speakers. Attention, Perception & Psychophysics, 71(6), 1385-1398.

- Pfordresher, P. Q., Brown, S., Meier, K. M., Belyk, M., & Liotti, M. (2010). Imprecise singing is widespread. *The Journal of the Acoustical Society of America, 128*(4), 2182-2190.

- Pfordresher, P. Q., & Mantell, J. T. (2014). Singing with yourself: evidence for an inverse modeling account of poor-pitch singing. Cognitive Psychology, 70, 31-57.van Besouw, R. M. V., Brereton, J. S., & Howard, D. M. (2008). Range of tuning for tones with and without vibrato. Music Perception, 26(2), 145-155.

- Warrier, C. M., & Zatorre, R. J. (2002). Influence of tonal context and timbral variation on perception of pitch. Perception & Psychophysics, 64(2), 198-207.

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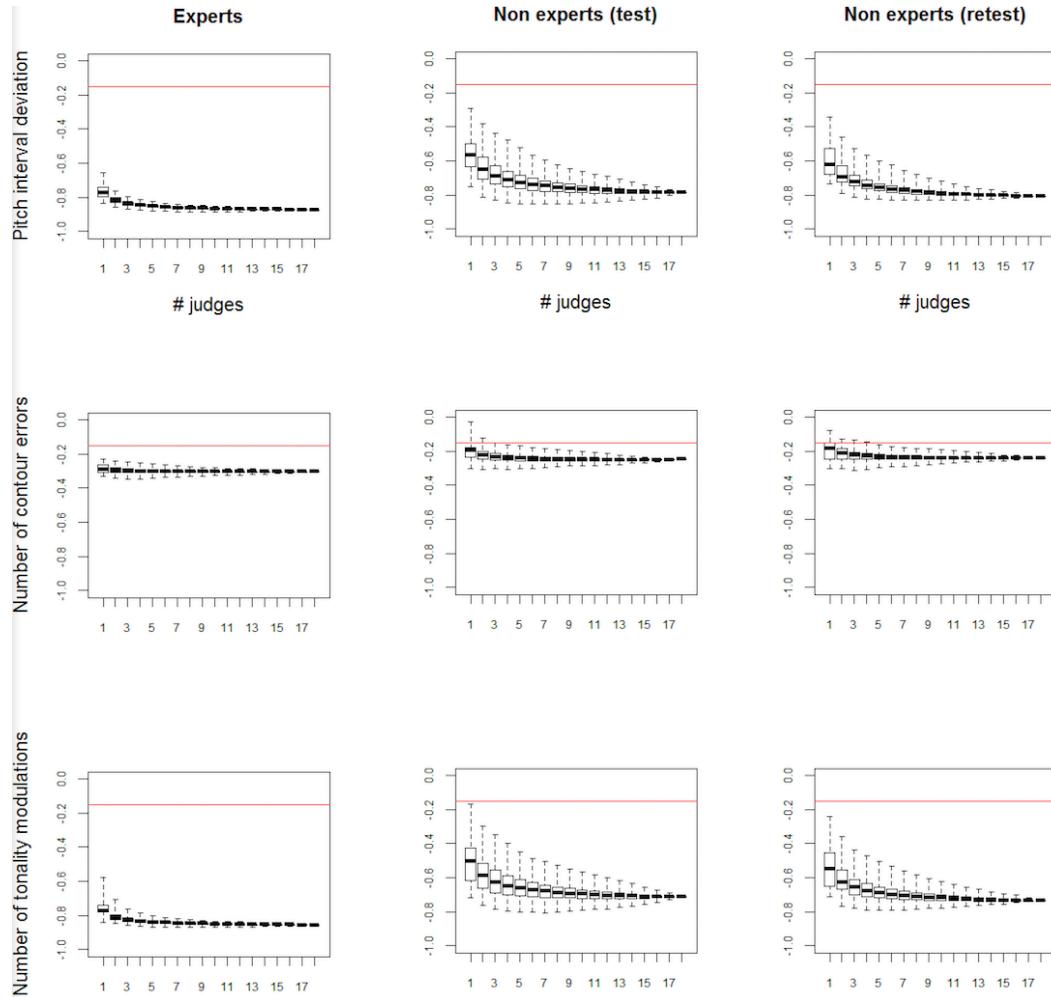
F(3,165) = 231.51; p < .01	
81%	
Interval deviation Tonality modulations	

F(3,165) = 104.44; p < .01	
66%	
Interval deviation	

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