The Effects of Timbral Variation on Melodic Perception

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Sample Stimuli

Introduction

- The ability to recognize a familiar melody regardless of the instrument on which it is played implies that pitch and timbre function independent of one another.
- Work by Warrier and Zatorre (2002), however, found that changing timbre influenced pitch judgments for tones presented in isolation, and as the last note of familiar melodies
- Such findings suggest that timbre and pitch are interactive in melody perception.

The current project examined pitch-timbre interactions using standard – comparison recognition memory judgments of melodic pairs (Dowling, 1994). These experiments examined:

- **Experiment 1:** The impact of constant timbres versus randomly varying timbres, on a note-by-note basis, on melody recognition.
- **Experiment 2**: The impact of imposed structure of timbre variation via three note timbre groupings on melody recognition.
- **Experiment 3**: The impact of structured, three note cyclical variation on melody recognition.

Methods

Participants: Musically trained (≥ 5 yrs) and untrained (< 5 yr) participants:

Stimuli & Experimental Task: A standard (STND) – comparison (COMP) recognition memory task in which listeners judged whether the pairs of melodies were the same or different. Pairs of melodies were manipulated in two ways: *Comparison Type* and *Melody Timbre*.

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Methods

Comparison Type: Three comparison melodies (Figure 1):

- *Transpositions*: Same contour & intervals for STND and COMP
- *Same Contour*: Same contour, diff intervals for STND and COMP
- *Different Contour*: Diff contour, diff intervals for STND and COMP

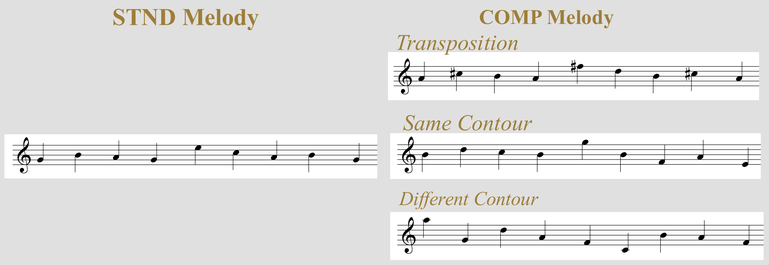

Figure 1: Comparison type manipulations employed in all experiments

Melody Timbre: Guitar, Saxophone, and Trumpet

Experiment 1: *Constant vs Variable Timbres* (Figure 2)

- STND / COMP contained constant timbres or varying timbres

Experiment 2: *Variable Timbres: Three-Note Groupings* (Figure 2)

- STND / COMP contained grouped sets of three timbres, order of groups matching or mismatching

Experiment 3: *Variable Timbres: Three-Note Cyclic groupings* (Figure 2)

- STND / COMP contained three-note cyclic groupings, order of groups matching or mismatching

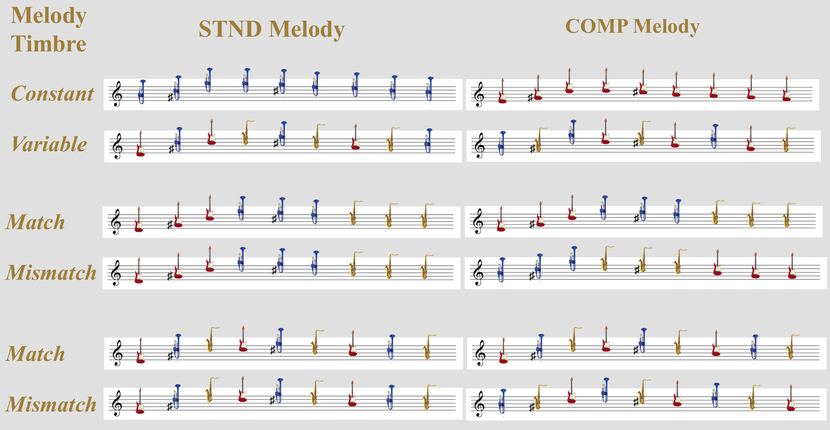

Figure 2: STND and COMP melodies as a function of *Melody Timbre*, Experiment 1 (top), Experiment 2 (middle), and Experiment 3 (bottom)

Results

- Same/different judgments converted to %corr, used to calculate d primes, with %corr for same and different contours as Hits, and 1-%corr for transpositions as FAs
- D primes analyzed in 3-way ANOVAs (*Comparison Type*, *Melody Timbre*, and *Musical Training*); see Figure 3 (all 3 experiments)

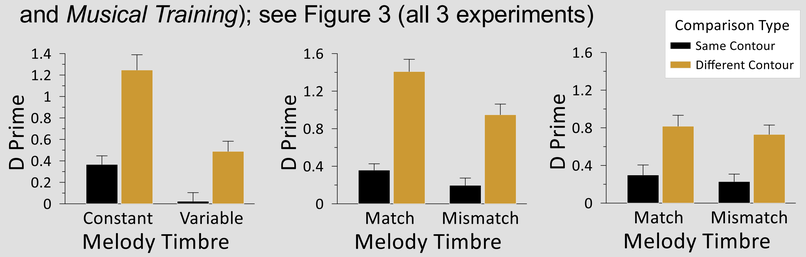

Figure 3: D primes for Experiments 1 (left), 2 (middle) and 3 (right)

Factor	Experiment 1	Experiment 2	Experiment 3
Comparison Type	66.8****	89.4****	58.1****
Melody Timbre	55.3****	20.2****	0.67
Comparison x Timbre	9.1***	6.3*	0.04

- *Comparison Type:* Different contour > Same Contour
- *Melody Timbre:* Constant/matching timbres > variable/mismatching timbres
  Comparison Type & *Melody Timbre* interaction: Different contour > Same contour more pronounced for constant/matching timbres

Conclusions

- Note-to-note timbre variation leads to poorer melodic recognition (Experiment 1).
- Detrimental effects of timbre variation reduced with timbral constancy in melodic note groupings (Experiment 2).
- Timbral constancy insufficient to overcome the impact of note-to-note timbre variation on melodic recognition (Experiment 3).
- Ultimately, these results are consistent with ideas of pitch – timbre interaction in melodic processing, such that timbral variation within melodies can inhibit melodic recognition.

References

Dowling, W. J. (1994). Melodic contour in hearing and remembering melodies. In R. Aiello & J. A. Sloboda (Eds.), *Musical perceptions* (pp. 173–190). Oxford University Press.

Warrier, C.M., Zatorre, R.J. (2002)Influence of tonal context and timbral variation on perception of pitch. *Perception & Psychophysics 64*, 198–207. https://doi.org/10.3758/BF03195786