How do perceptual benefits from musical experience compare with those from speech experience?

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Introduction

Acoustic consistency facilitates perceptual processing while variability challenges it.

- Perceptual interference tasks: Categorize a target word (or pitch) produced by a single talker (or instrument) or by one of multiple talkers (or instruments) in random orders
- Responses are faster and/or more accurate for single-talker (e.g., Stilp & Theodore 2020) and single-instrument conditions (e.g., Shorey et al., in press)

Listeners are experts at perceiving speech in their native language, but the role of expertise in the music versions has not yet been explicitly studied
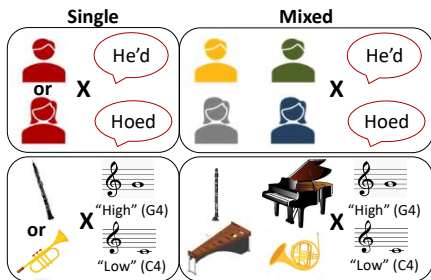
Research Questions:

(1) Does more musical training increasingly protect against timbral variability when making pitch judgments?
(2) How does musical expertise compare with speech expertise in overcoming variability?
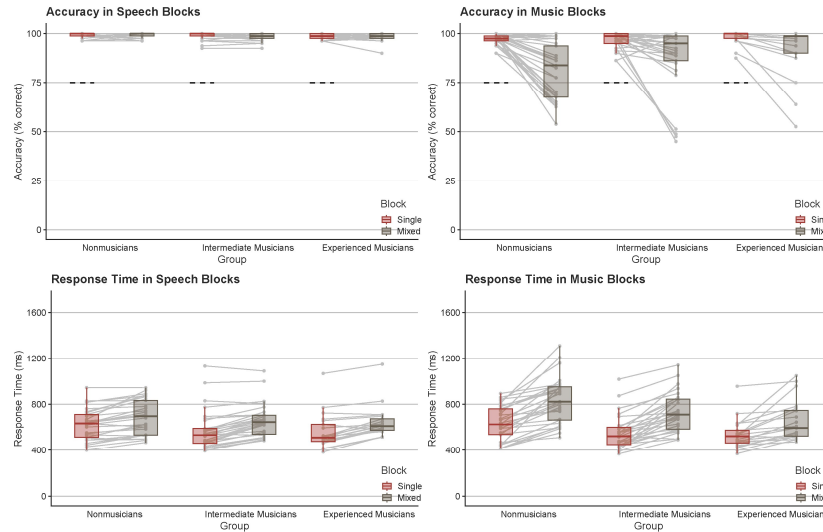
Method

- 29 **nonmusicians** (<2 years of formal training, not currently playing)
- 29 **intermediate musicians** (2-9 years of formal training, currently playing)
- 21 **experienced musicians** (10+ years of formal training, currently playing, started training by age 7)

All had self-reported healthy hearing and were native English speakers

Speech (Hillenbrand et al., 1995)

Single — He'd / **or** X / Hoed

Mixed — He'd / X / Hoed

Music (Opolko & Wapnick, 1987)

Single — "High" (G4) / **or** X / "Low" (C4)

Mixed — "High" (G4) / X / "Low" (C4)

2AFC task done online through Gorilla website

Results

Accuracy in Speech Blocks

Accuracy in Music Blocks

Response Time in Speech Blocks

Response Time in Music Blocks

Nonmusicians are hindered by variability more in the music domain than the speech domain, **Experienced Musicians** show similar effects of variability in both domains, & **Intermediate Musicians** pattern in between.

LMER: log(RT) ~ Block*Domain*Group + (Block*Domain|ID)
* = sig at .05, ** = sig at .01, *** = sig at .001

Modelled Reaction Times	Nonmusicians (NM) as default	Intermediate Musicians (IM) as default	Experienced Musicians (EM) as default
Block	Single < Mixed ***	Single < Mixed ***	Single < Mixed ***
Domain	Speech < Music ***	n.s.	n.s.
Group	NM > IM*, NM > EM*	IM < NM *, IM = EM (n.s.)	EM < NM *, EM = IM (n.s.)
Block x Domain	Music > Speech interference***	Music > Speech interference***	Music = Speech interference (n.s.)
Domain x Group (Speech → Music)	NM = IM, NM = EM **	IM = NM, IM = EM (n.s.)	EM ≠ NM **, EM = IM
Block x Domain x Group	NM's interference (Music > Speech) = IM's (n.s.) & ≠ EM's pattern *	IM's interference (Music > Speech) ≉ EM's (n.s.) & = NM's pattern (n.s.)	EM's interference (Music = Speech) ≠ NM's * and ≉ IM's patterns
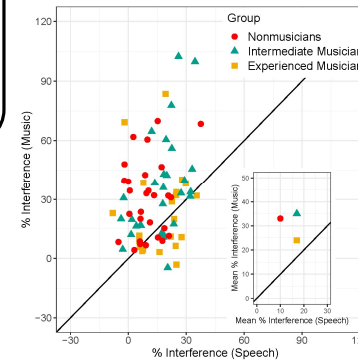
Discussion

Expertise does not eliminate perceptual interference, but it does mitigate it.

Revisiting Our Research Questions:

(1) People with increasing musical training were more resilient to variability in the music domain.
- Across groups, as musical training increased, responses were faster, more accurate, and interference decreased.
- However, musical training does not completely eliminate interference (Allen & Oxenham, 2014; Krumhansl & Iverson, 1992)
- Although, our study is cross-sectional, so these differences could be pre-existing

(2) Across domains, experienced musicians (who are experts in speech and music) show similar interference, while nonmusicians have less interference in speech (in which they're experts) than music (in which they're not).
- How close is the link between development of expertise and resiliency to variability?

Extending this work
- Do people who are experts in one language and at various stages of learning a second language pattern similarly to the musical experience effects we see here?

References

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