

Measuring music and prosody: Accounting for variation in non-native speech discrimination with working memory, specialized music skills, and music experience **Adam A. Bramlett¹; Bianca Brown; Jocelyn Dueck; Seth Wiener²** Carnegie Mellon University

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Background	Language AX Tasks				Research Questions	
 Learning non-native speech contrasts is difficult [4, 5, 7]. Musical ability can positively impact sensitivity to speech sounds, yet how musical ability is operationalized and measured varies from study to study. General musical skills/aptitude and general cognitive abilities (e.g., [8]) have been linked to (and disputed as) successful predictors of improved non- 	 Italian [6] 27 pairs of stop geminate contrasts Half words/non-words pairs Spoken by 3 native speakers Balanced speaker, position, and lexical status 	Geminate /Ek:o/ Here	Non-g /Eko/ Echo d, g, cʒ/		 To what extent do productive and perceptive measures of musical skill predict non-native speech sensitivity in Italian, Japanese, and Mandarin? To what extent does self-reported music sophistication predict non- native speech sensitivity in Italian, Japanese, and Mandarin? To what extent does working memory predict non-native speech sensitivity in Italian, Japanese, and Mandarin? 	
 native speech perception. [8, 12] finds that music aptitude is only a weak predictor of variation in non-native speech perception, whereas general cognitive abilities are more reliable. 	Japanese [6]	ent S-match	Geminate Low-high /kat:e/	Non-geminate High-low /kate/	The Current Experiment	
 [13] finds that musical ability is strongly tied to speech-level language abilities. Our aim is to tease apart music skills, music background, and working memory in 	 - 33 pairs of stop geminate contrasts - Half matching/non-rmatching pitch accent - All real words /t, k, tf/ 	itch Acce	Buying Geminate	Win Non-geminate	Ek:0	

the perception of non-native speech contrasts across three languages.

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-rhythm

-melody





Music perception Music production Music survey -rhythm -5 areas -melody

Working memory -digit span +general score adaptive staircase

> 51.4

> 36.1

<51.4

< 36.1

Goldsmiths Sophistication Questionnaire [3]

Examples:

Engagement I engaged in regular, daily practice of a musical instrument (including voice) for _____ years.

I am able to judge whether someone is a good Perception singer or not.

I have had _____ years of formal training on a Training musical instrument (including voice) during my lifetime.

Singing

If somebody starts singing a song I don't know, I can usually join in.

I am able to identify what is special about a Emotion given musical piece.

> General engagement score: Normalized score of overall engagement

Low-high Low-high /heta/ /het:a/ Unskilled Decreased

Mandarin [12]

- 4 Pairs of tonal contrasts - 1 female and 1 male native speaker - F0 contours were manipulated using Praat - Each tonal pairing co-occured equal amounts

recreate melody

13 melodies

Yu1	Yu2	Yu3	Yu4
迂	鱼	I	<u> </u>



Participants

- 48 L1 English speakers
- Prolific (n=15)
- In-person (n=33)

MUSIC Tasks





Cronbach's Alpha						
Task	Reported a	Our α				
Goldsmiths [3]	Range: 0.79 - 0.93	0.89				
Musical Ear tasks [2]	0.87	0.79				
Auditory-motor melody	Unreported	0.93				
Auditory-motor rhythm	Unreported	0.91				

Conclusions

- Musical ability is associated with improved language abilities... but the relationship between music sub-skill, self reported music experience, and language abilities is complicated.
- RQ1: Musical pitch perceptual abilities do indeed account for Mandarin tone sensitivity similarly; rhythm ability and Japanese geminate perception are strongly linked.
- **RQ2:** Our methods of assessing music ability were reliable (see α). Whereas specialized skills in music are positively predictive of non-native speech sensitivity, musical self-reported measures have the opposite effect.
- RQ3: Both the Japanese and Italian models suggest that working memory is a crucial predictor for sensitivity to geminate contrasts. We suspect that the lack of effect in Mandarin is due to the homogeneous stimuli we used.

References

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Speech Prosody 2024



