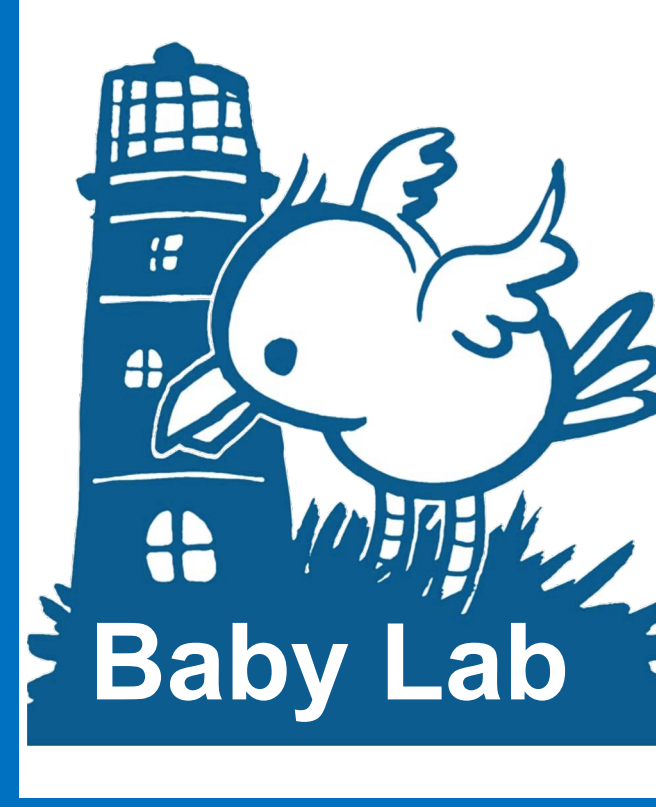




# Musical expertise weakens the cost of dividing attention between vision and audition

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## QUESTION: How does musical expertise affect attending between vision & audition?

Dividing attention across sensory modalities has been shown to impair performance (e.g. Ciaramitaro et al., 2017), suggesting attention is a limited resource shared across sensory modalities. Musical training often involves the flexible use of two or more senses concurrently (e.g. reading musical scores and listening to sounds) and has been shown to reduce the cost of unimodal dual-task performance (Moradzadeh et al., 2015). Yet, little is known regarding how musical experience might reduce the cost of crossmodal divided attention. Here we used a crossmodal dual-task to compare the cost of crossmodal divided attention in musicians and non-musicians. Importantly, we use non-musical visual and auditory stimuli, visual letters and amplitude modulated white noise (auditory contrast), as the stimuli to which attention was directed.

## METHODS & ANALYSIS

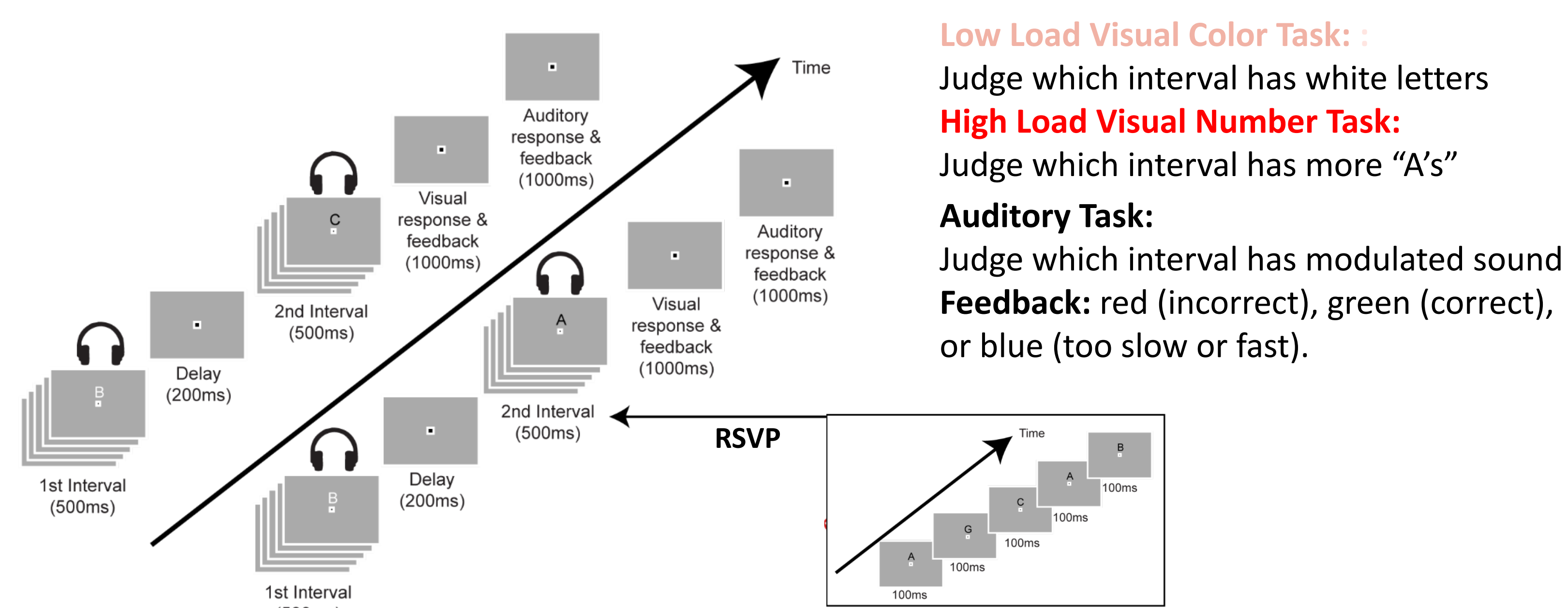
### Quantifying musical ability/experience and training (Day 1)

**Brief PROMS** (Profile of Musical Perception Skill, developed by Law & Zentner, 2012; validated by Kunert et al., 2016) – to assess melody, tempo, tuning and rhythmic accent.

**Musical Experience Questionnaire** – to categorize participants based on 3 criteria: **Training Onset** (5-16 years old), **Years Training** (10+ years), **Practice Intensity** (~15 hours/week average; minimum 7 hrs/week).  
**Category 0:** met 1 or no criteria; **Category 1:** met 2 criteria; **Category 2:** met 3 criteria

**Training** – to familiarize participants with our crossmodal dual-task we first trained on the auditory task alone, then the visual task alone (color and number separately), then the visual and auditory tasks together.

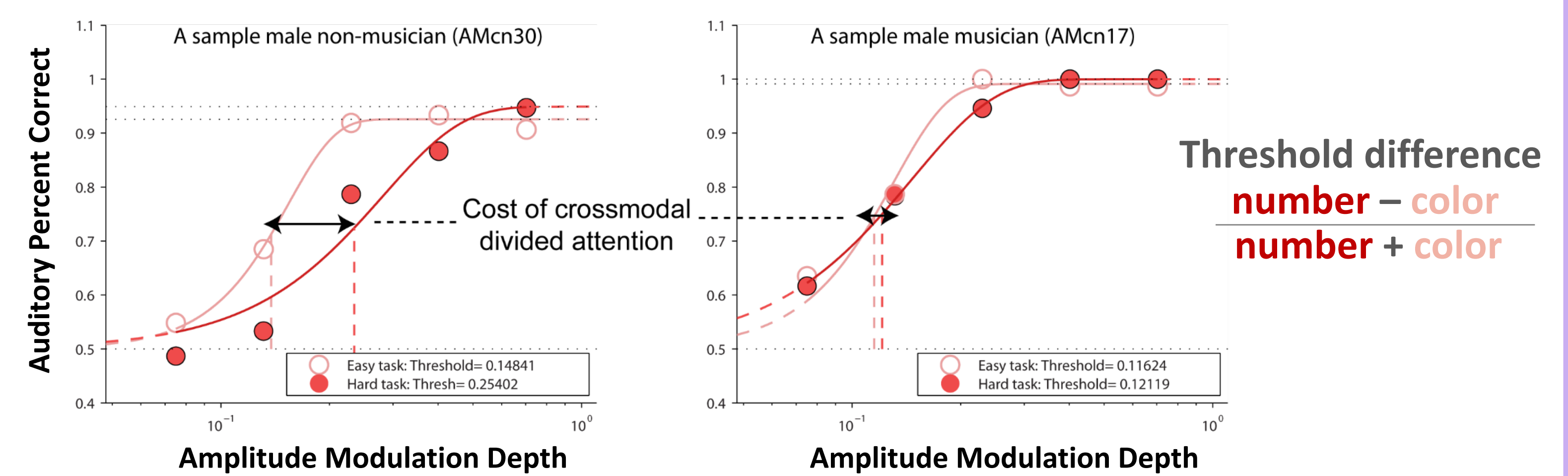
### Quantifying audio-visual crossmodal divided attention (Day 2)



### Demographics

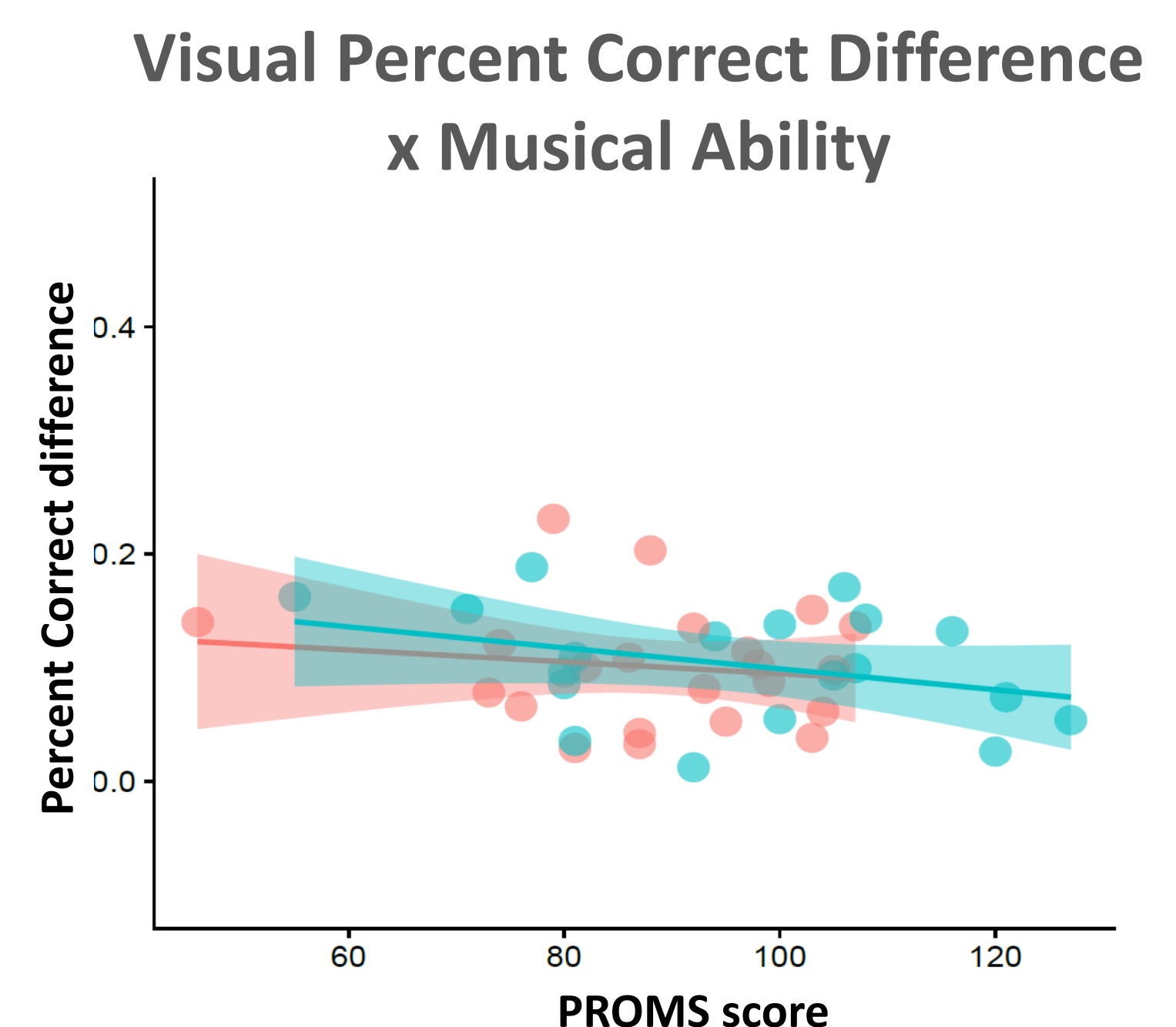
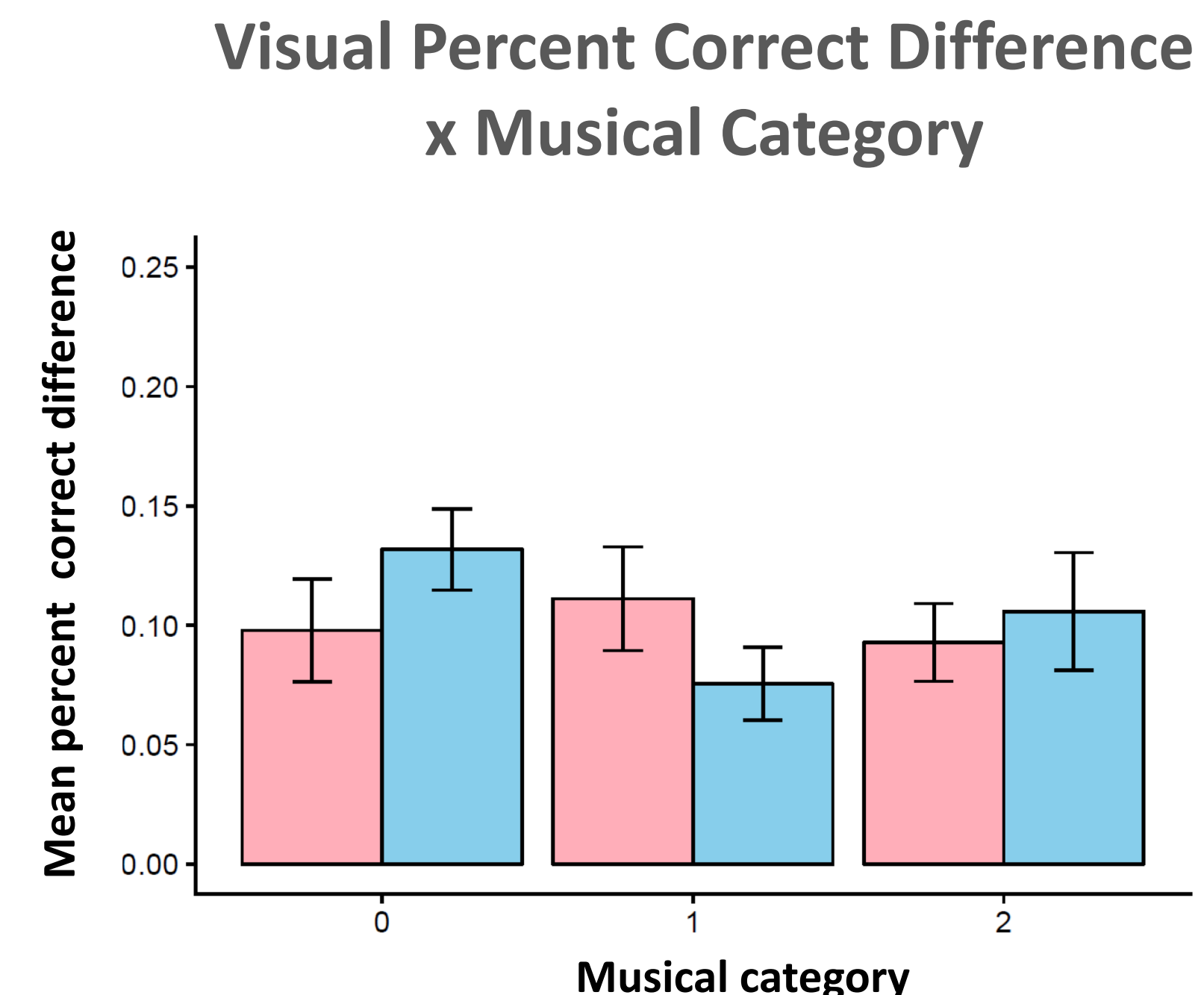
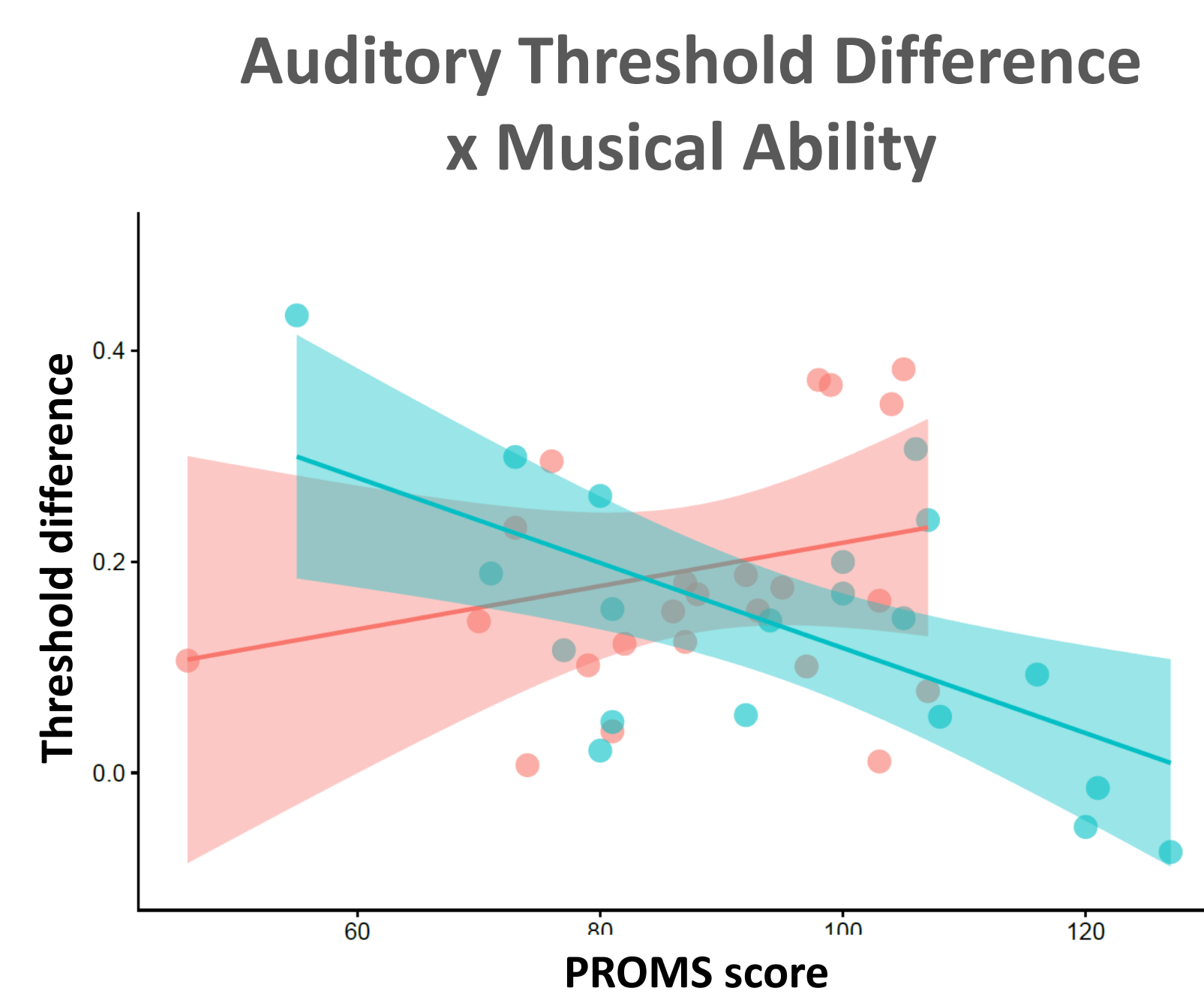
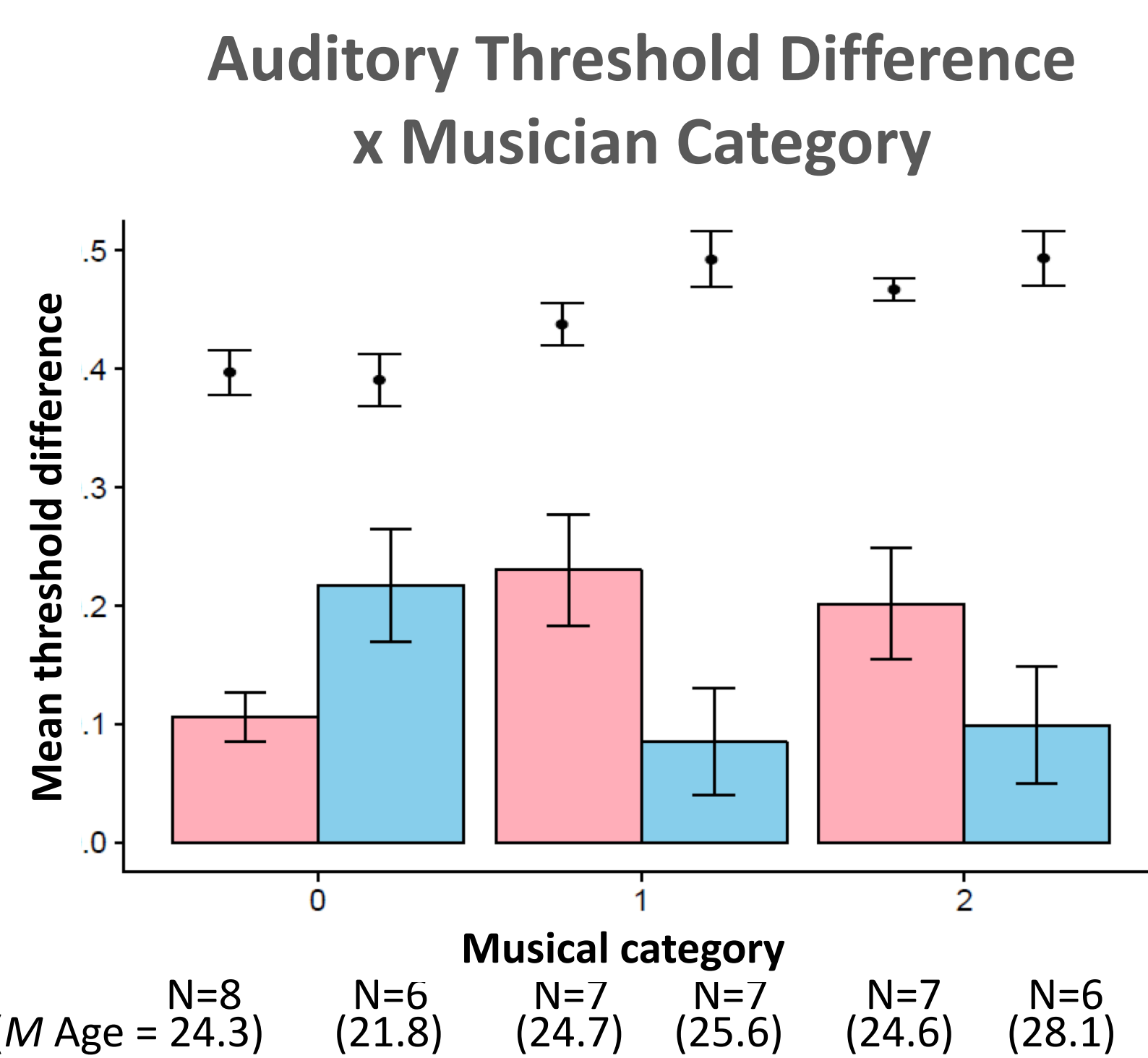
Musical Category	0		1		2	
	Female	Male	Female	Male	Female	Male
Sex						
N	8	6	7	7	7	6
Mean Age (SD)	24.3 (3.71)	21.8 (1.49)	24.7 (4.56)	25.6 (5.02)	24.6 (2.88)	28.1 (4.59)
Mean PROMS total (SD)	80.3 (15.3)	78.2 (16.3)	90.3 (14.2)	103.9 (16.2)	97.3 (6.73)	104.2 (14.5)
Mean # years training (SD)	2.50 (2.93)	2.00 (2.19)	13.4 (5.09)	15.7 (4.50)	17.9 (4.60)	17.8 (5.38)
Mean onset age (SD)	5.50 (6.32)	7.33 (8.07)	7.43 (2.70)	9.29 (3.40)	5.71 (1.89)	9.33 (3.56)
Mean hrs/week training (SD)	0.31 (0.88)	0 (0)	1.43 (2.70)	5.71 (10.4)	16.3 (13.7)	22.6 (17.7)

**Hypothesis:** Musicians, compared to non-musicians, will show a smaller cost of dividing audio-visual attention, smaller auditory threshold differences for easy vs hard visual tasks.



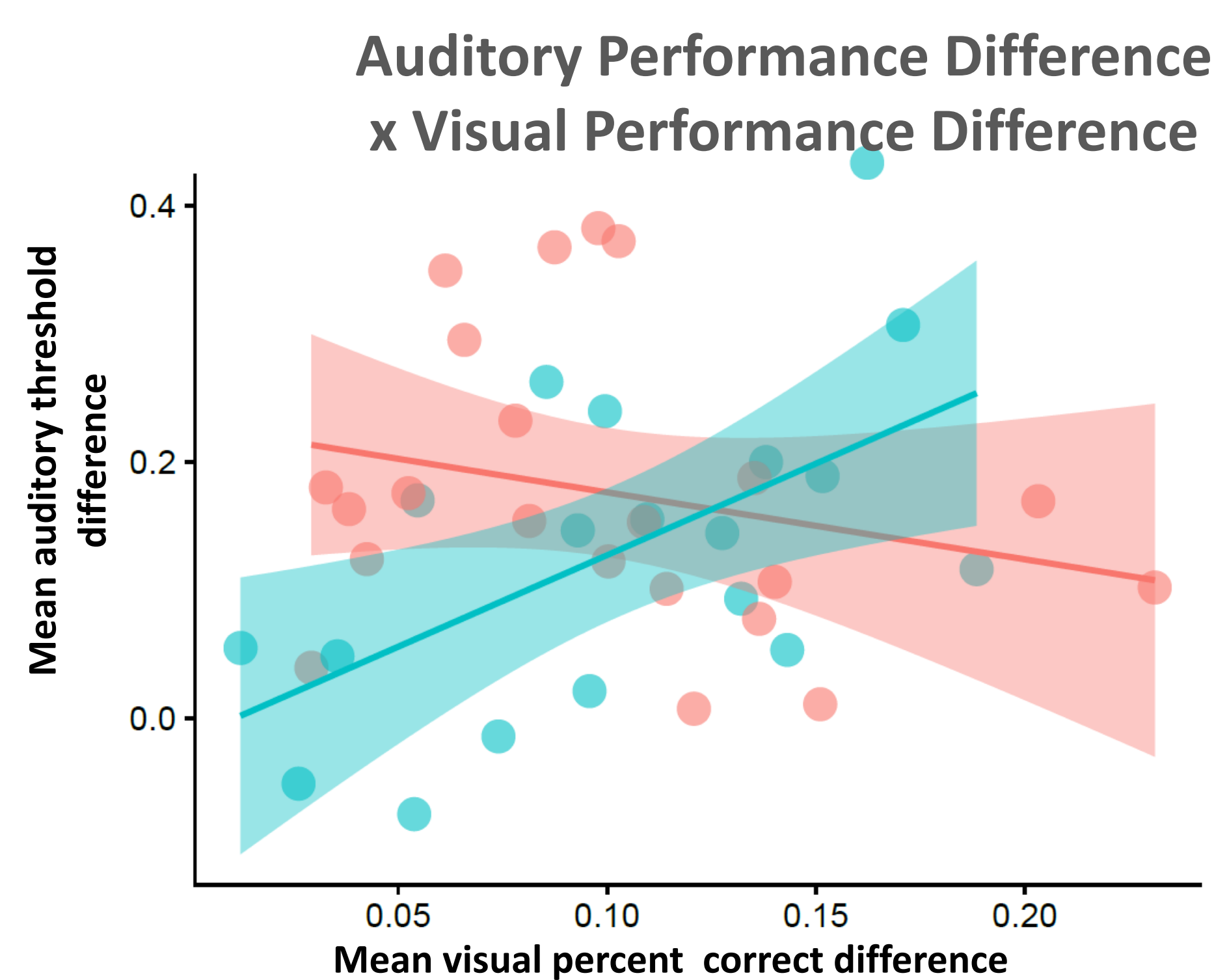
## RESULTS

Female Male



Male musicians tend to show smaller auditory threshold differences than male non-musicians. Males with better musical test scores tend to show smaller auditory threshold differences. We did not find similar effects of musical expertise in females.

We did not find any systematic effects of musical expertise, either based on musical test scores or our pre-defined musical categories, on visual performance differences, for males or females.



Overall, male musicians could better divide their attention between unrelated visual and auditory stimuli: with increasing benefits to visual performance (smaller percent correct differences) there were increasing benefits to auditory performance (smaller threshold differences). Female musicians failed to show the same trends.

## CONCLUSION: Musical expertise improves crossmodal divided attention, but ...

Further research is needed to understand:

- 1) What contributes to the observed gender differences in our sample?
- 2) What is the select role of extensive training?
- 3) What neural mechanisms subserve these behavioral effects?

References:

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