

The Effects of Music and Dance Training on Beat Perception and Production

Abilities in Parkinson's Disease

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Introduction

- A **beat** is a sense of a regular pulse in music.
- Accuracy of beat perception and synchronization varies across individuals²
- Perception and production accuracy are impacted:
 - Positively by music and dance training³
 - Negatively by neurological changes in Parkinson's disease (PD)¹
- Rehabilitative strategies for PD frequently use rhythm synchronization tasks (e.g., walking to the beat in music) to regulate motor symptoms⁴
- Little is known about how music or dance training impact beat production/perception abilities in this population

This exploratory study examines how:

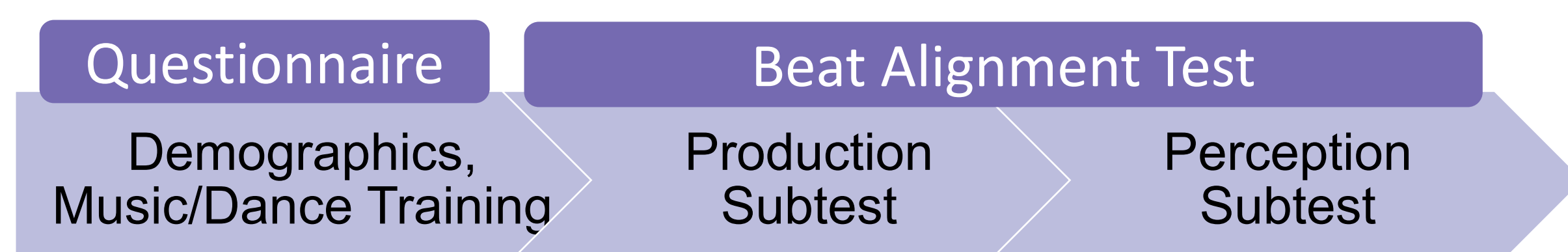
- Beat perception and production accuracy differ among healthy younger adults, healthy older adults, and people with early-stage PD across varying levels of music and dance training.
- We predicted that:
 - People with PD would demonstrate lower accuracy overall
 - That both people with and without PD would demonstrate increased accuracy with greater music training

Methods

Participants: sample of 450 participants across a variety of walking and music studies conducted in the Grahn Lab

	N =	Age	Music Training (Years)			Dance Training (Years)	
			0-2	3-5	6+	0-5	5+
	450	Years (SD)					
Younger Adults	278	20.41 (3.01)	111	66	101	241	37
Older Adults	132	64.63 (9.27)	69	13	50	113	19
People with early-stage PD	40	68.28 (7.73)	24	9	7	39	1

Procedure:



Production Task

Tap spacebar in time to the beat (in 24 trials)

Dependent Variables:

- Asynchrony:**
 - Absolute difference between tap time and nearest beat position (ability to match response to beat period of music, or "tapping variability")
- Coefficient of Deviation (CDEV):**
 - Absolute deviation between inter-tap interval and inter-beat interval (ability to match response to music tempo, or "tapping accuracy")

Perception Task

Judge if superimposed beep track is on/off beat (in 24 trials)

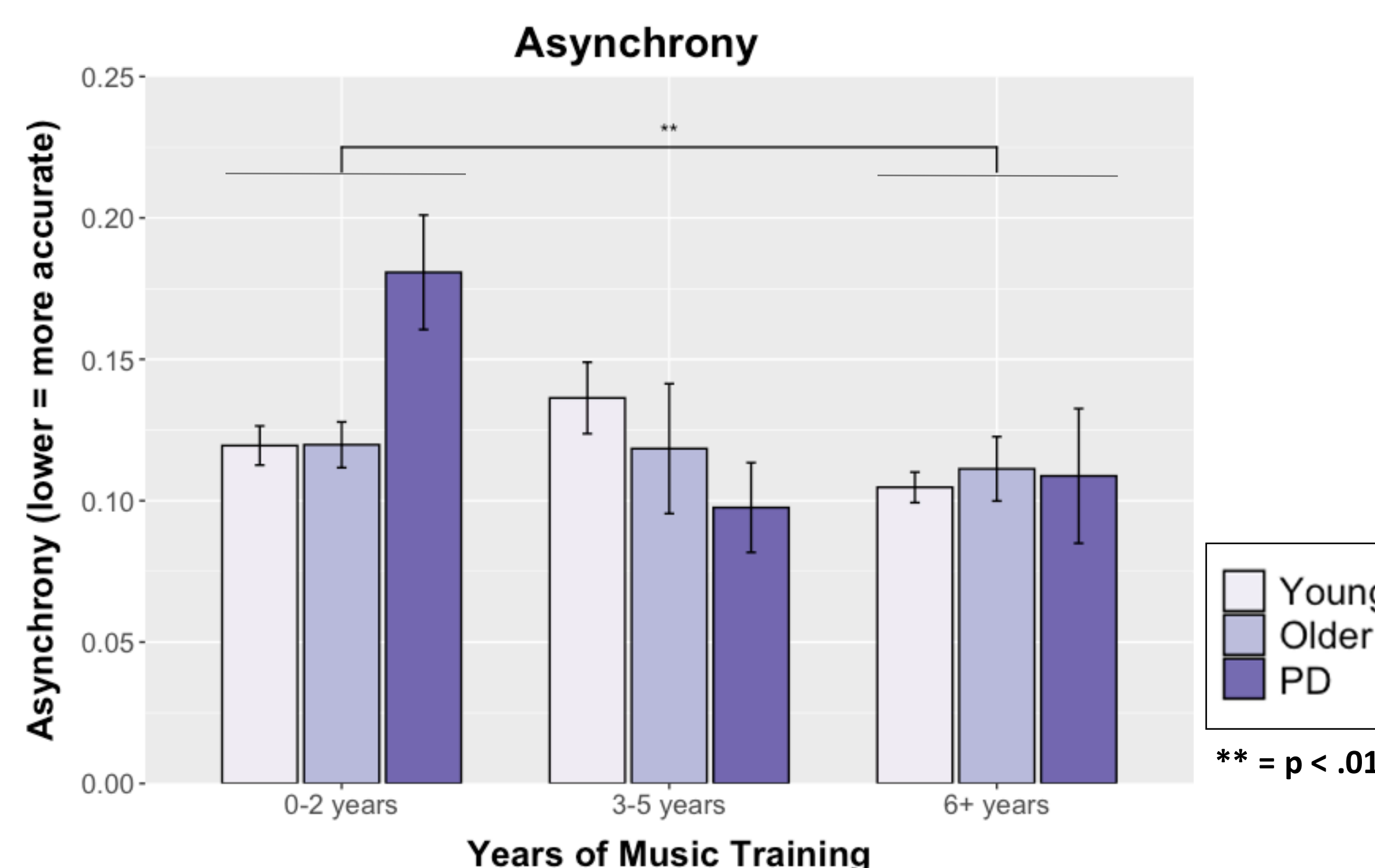
Dependent Variable: Perception Trial Accuracy (% correct)

Analyses:

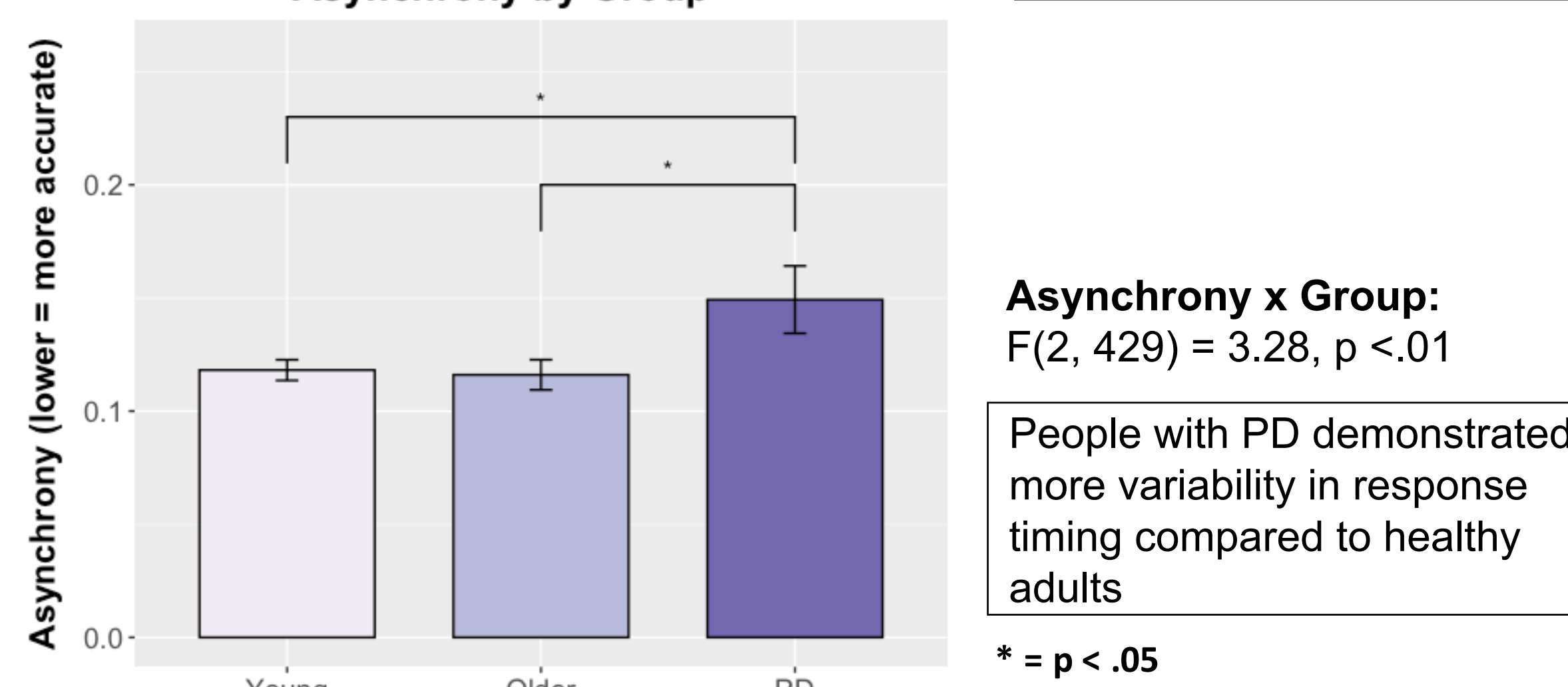
Three 3x4x2 Factorial ANOVAs (group x music training x dance training)
(DVs: Asynchrony, CDEV, Perception Trial Accuracy)

Results

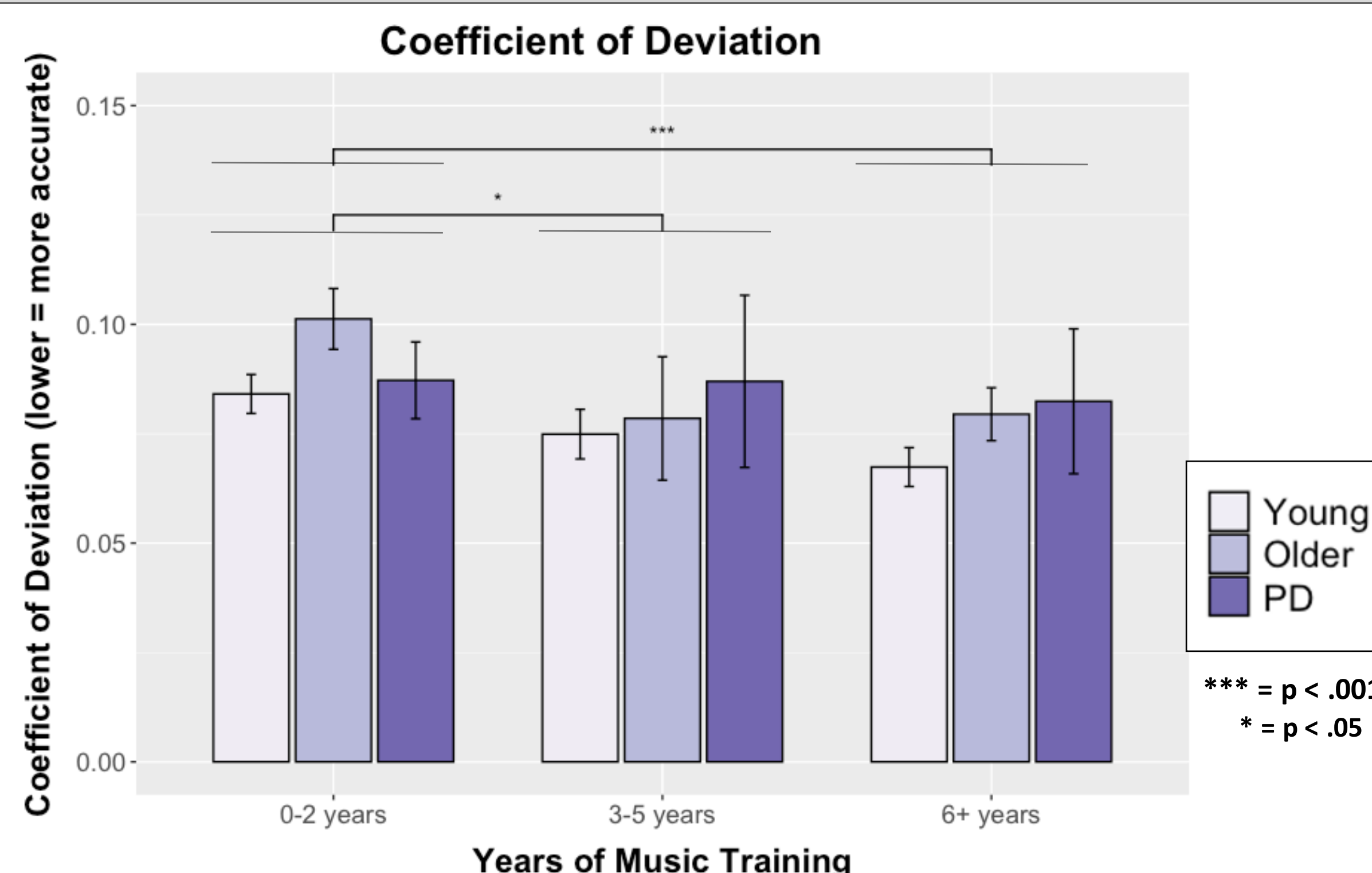
Beat Production (Asynchrony)



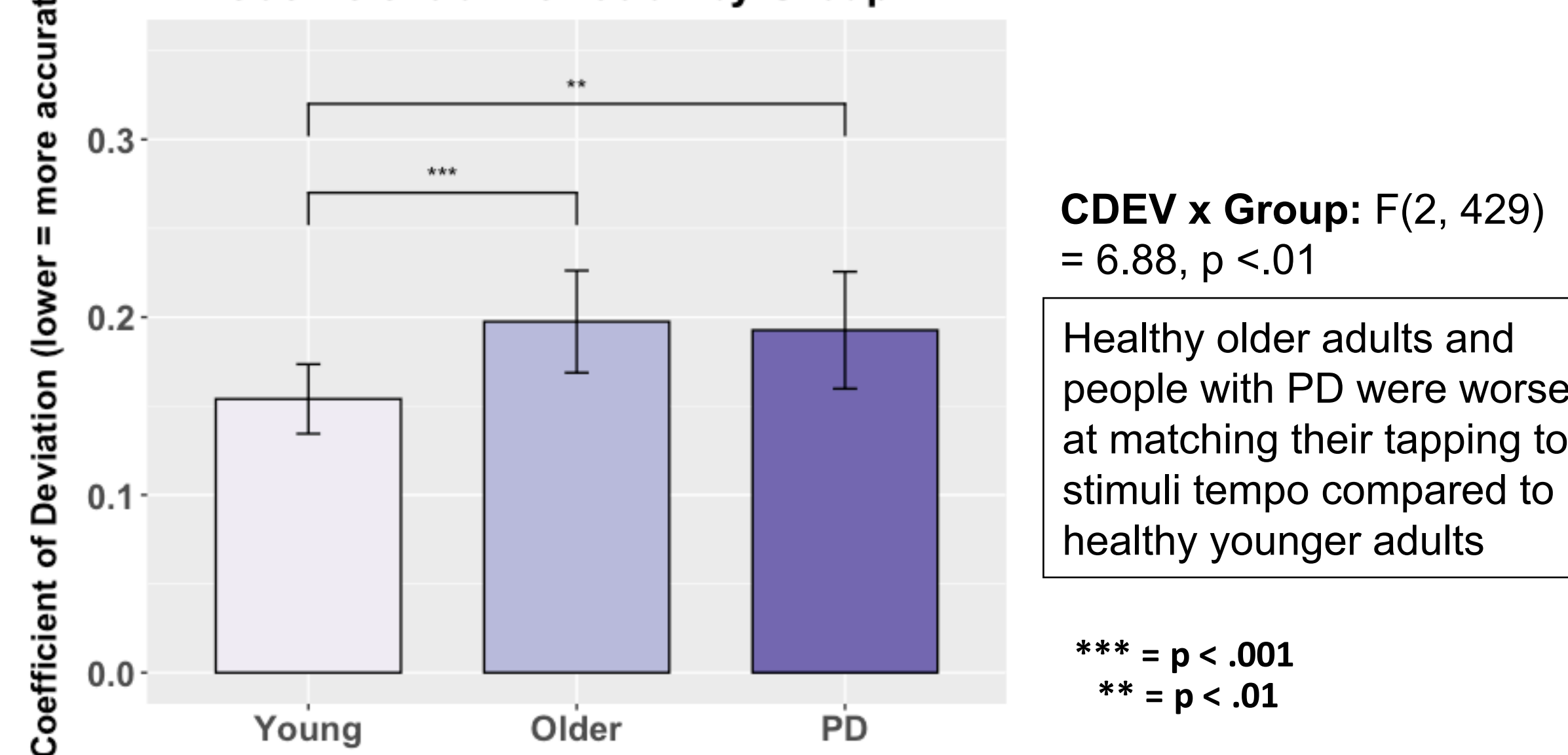
Asynchrony by Group



Beat Production (CDEV)

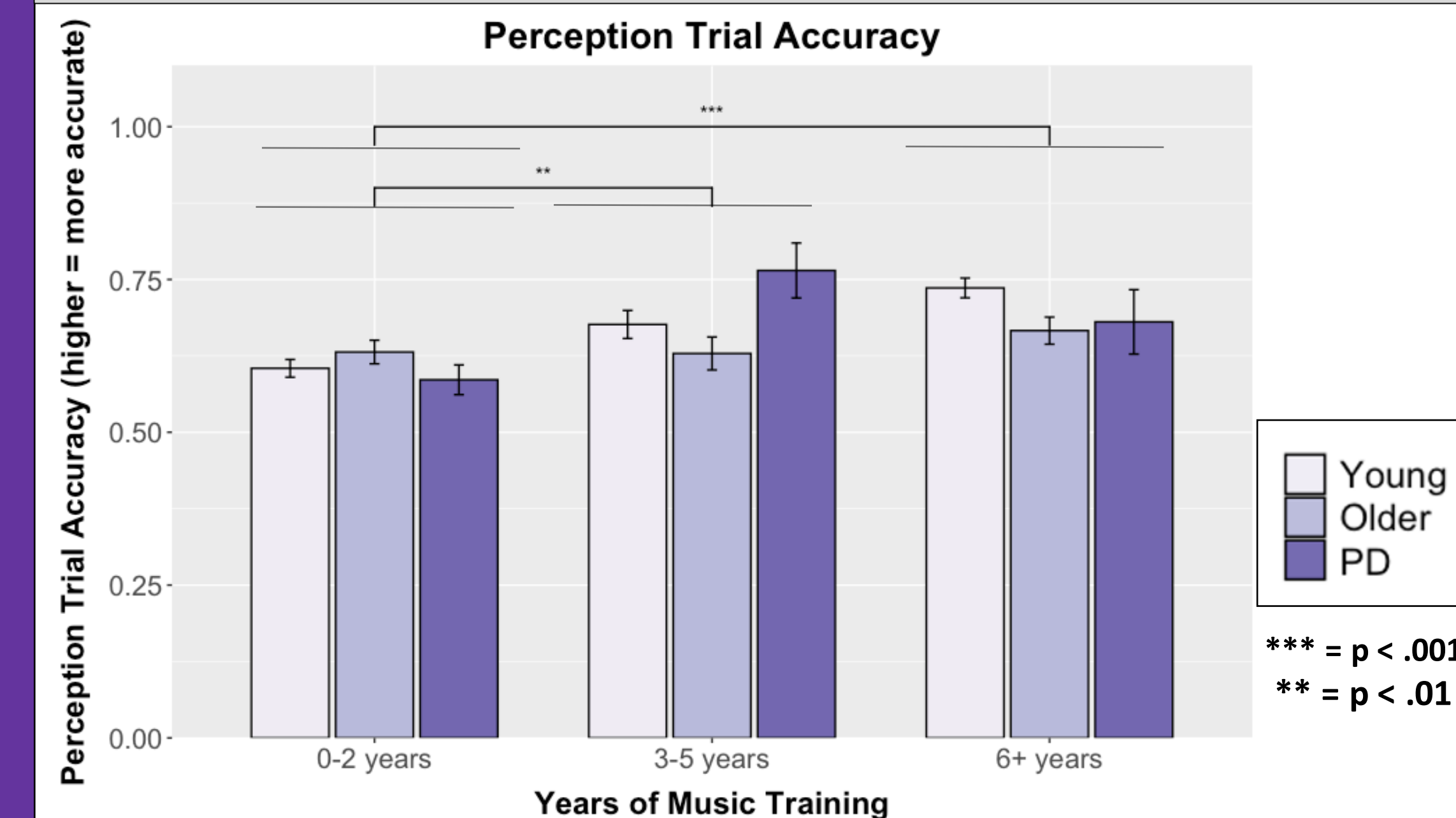


Coefficient of Deviation by Group



Results

Beat Perception



Discussion

Summary of findings:

- People with early-stage PD demonstrated no perception deficits, but were impaired on beat production compared to healthy adults
- People with PD and longer music training experience demonstrated more accurate beat production abilities
- No significant differences based on dance training, this may be due to limited dance data

Implications:

- Music training may relate to more accurate motor timing behaviors
 - Auditory-motor networks could be better preserved among musicians than non-musicians with PD
- The BAT could screen people with PD who would benefit from rhythm-based interventions by identifying those with more intact motor-timing abilities on rhythm tasks

Future studies should examine:

- whether the positive effects of music training on beat production apply to other motor modalities (e.g. clapping, bouncing, walking)
 - If the BAT can identify this, it could be used to screen appropriate candidates for rehabilitative strategies
- Whether the positive effects of music training on beat production extends to later stages of PD

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Acknowledgments

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