

# Influence of Auditory Load and Beat Perception in Rhythmic Auditory Cueing



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## Introduction

- Gait parameters such as stride time variability<sup>1</sup> and stride length variability<sup>2</sup> are associated with incidence of falls among seniors
- Rhythmic auditory cueing (RAC) is a type of intervention in which participants walk to metronome cues
- The accuracy of beat perception varies across individuals
  - It was associated with better synchronization in RAC among young adults<sup>3</sup>
  - Patients with Parkinson's disease<sup>4</sup> who responded positively to cueing showed on average better perception than those who did not respond positively to cueing<sup>4</sup>
- Adding a concurrent cognitive task to walking can be detrimental to older adults' gait<sup>5,6</sup>
- However, little is known about whether an auditory load added to walking would affect stride time variability in healthy old adults

### The present research questions were

- Would the increase in stride time variability (STV) of dual-tasks compared to single-task walking differ among age groups?
- If so, would it differ across the auditory complexity?
- Would the individual differences in beat perception moderate the RAC benefits in healthy old adults?

## Methods

### Participants

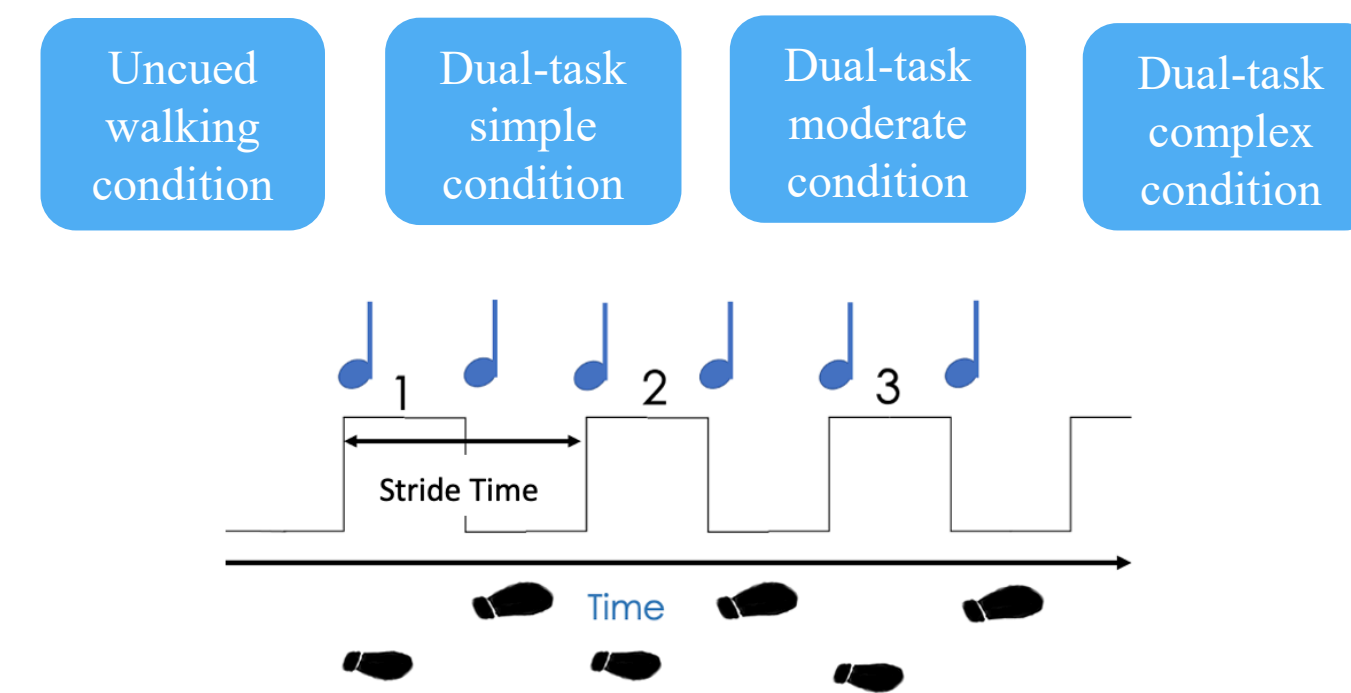
- Healthy older ( $n = 5$ ,  $M_{age} = 70$ ,  $SD_{age} = 6.02$ )
- Younger adults ( $n = 11$ ,  $M_{age} = 23$ ,  $SD_{age} = 3.08$ )

### Measures

- Session 1
  - Self-reported mental health, test of physical mobility, tests of cognitive abilities, standardized audiometric test and ratings of musical abilities
  - The beat alignment test (BAT) measures beat perception. Participants judged if the superimposed metronome were aligned or not with the excerpt of music
- In session 2
  - Listening tasks, walking tasks and both at the same time
  - STV data were recorded on a pressure-sensitive mat (ProtoKinetics Zeno Walkway)

## Methods

- Auditory stimuli were played at 10% faster than natural cadence (steps per mins) and had three levels of complexity that are counterbalanced:
  - Simple: low tones
  - Moderate: high & low tones
  - Complex condition, same as moderate, monitor for a target sequence of four tones



- Dependent Variable: Dual-task costs scores (DTC) were calculated as a percentage:

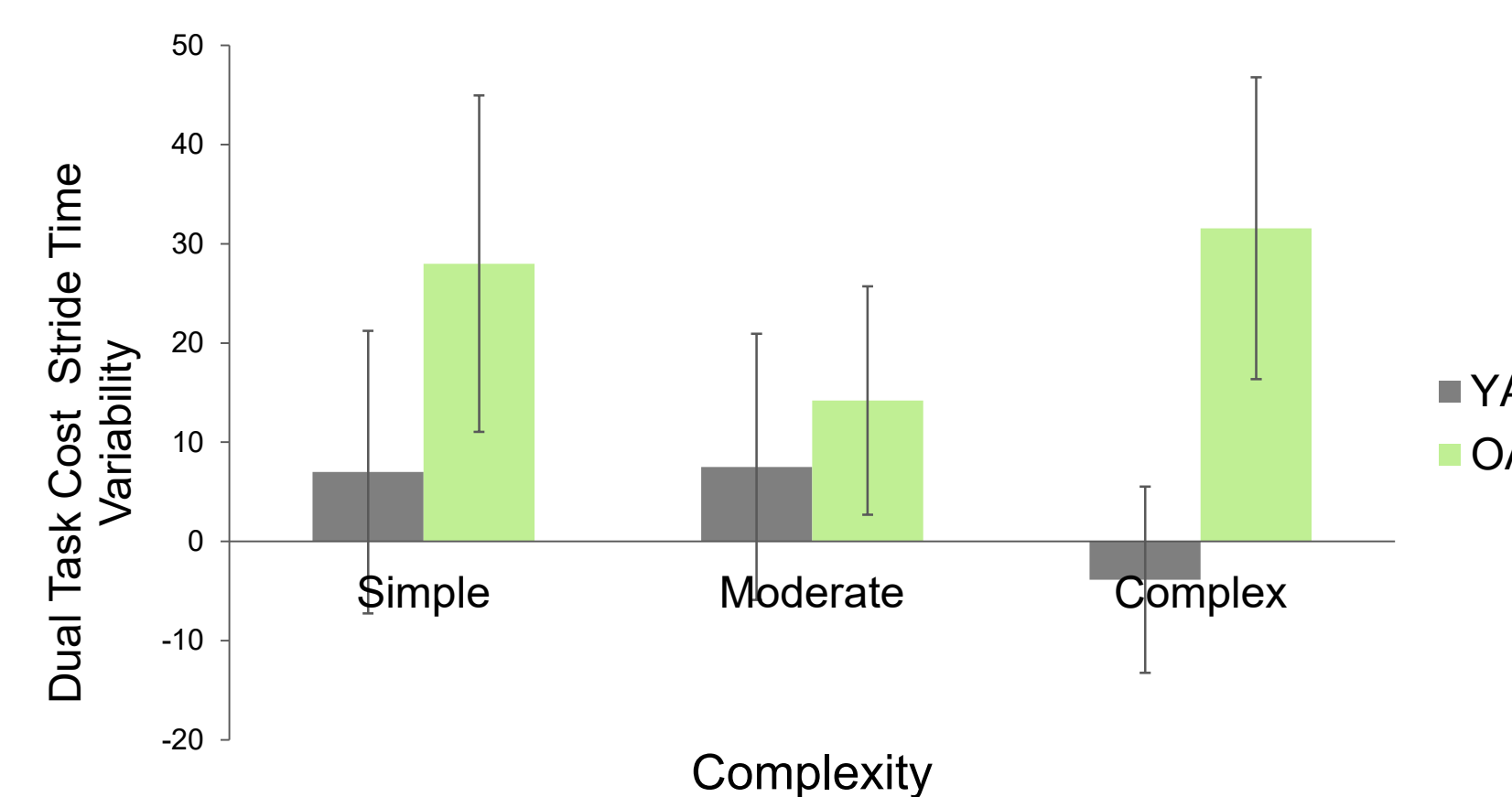
$$DTC\ STV = \frac{\text{dual task STV} - \text{single task STV}}{\text{single task STV}} \times 100$$

### Analyses

- Mixed ANOVA using factors Age Group and Complexity and outcome DTC STV
- Correlational analyses using scores of the BAT and of DTC STV

## Results

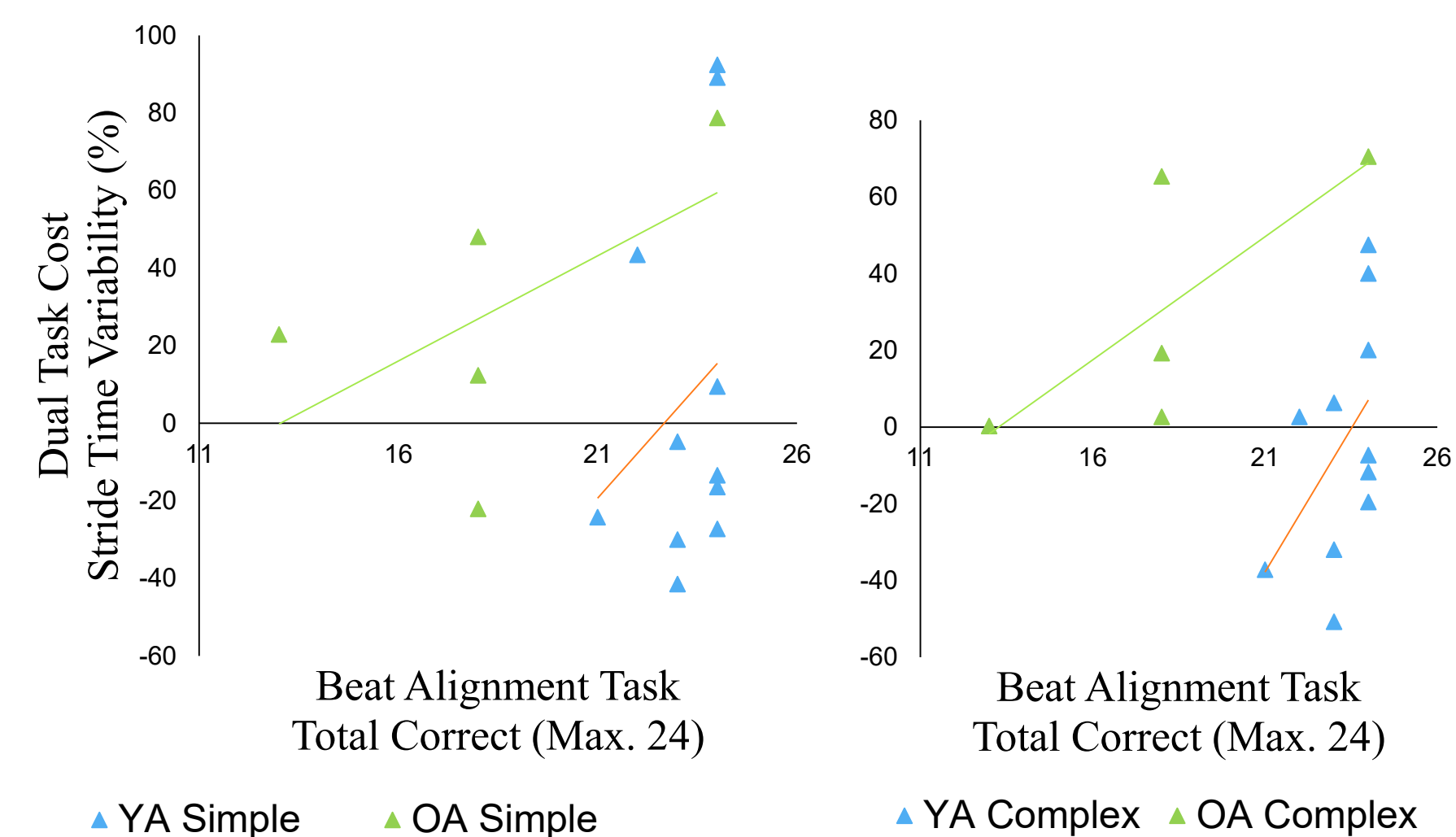
### Dual-task Complexity



## Results

Complexity:  $F(2, 28) = 0.303$ ,  $p = 0.741$ ,  $\eta_p^2 = 0.019$   
 Complexity  $\times$  Age Group:  $F(2, 28) = 1.418$ ,  $p = 0.258$ ,  $\eta_p^2 = 0.090$   
 Age Group:  $F(1, 14) = 1.257$ ,  $p = 0.281$ ,  $\eta_p^2 = 0.082$

### Beat Perception



### Simple condition

Older adults:  $R = 0.558$ ,  $p = 0.328$ ; Younger adults:  $R = 0.247$ ,  $p = 0.463$

### Complex condition

Older adults:  $R = 0.736$ ,  $p = 0.156$ ; Younger adults:  $R = 0.484$ ,  $p = 0.131$

## Discussions

- Older adults ( $M = 3.55$ ,  $SD = 10.49$ ) showed greater DTC STV compared to young adults ( $M = 24.59$ ,  $SD = 15.56$ )
- No interaction between complexity and age group was found for DTC STV
  - Nonetheless, young adults and old adults showed the greatest between-group difference in of the complex condition
  - Older adults' walking was more variable in all dual-tasks
  - Young adults showed a facilitative effect in the complex condition with a DTC STV of -3.86% ( $SD = 47.25$ )
- Older adults and young adults showed positive associations between DTC STV and BAT scores
  - The associations were the most noticeable in the complex condition
  - Their strength were stronger for older adults compared to younger adults

## Discussions

### Limitation

- Existing sample size was not to the ideal sample size to achieve a power of 0.80
- The number of older adults was very small, and the variance was large, hence true outliers are less easily identified

### Implications

- RAC is not likely to improve the temporal consistency of walking in healthy older adults when compared to usual uncued walking
- Beat perception could be a potential moderator of dual-task facilitation and cost
- In the future, researchers could examine the spatial gait parameters such as stride length variability

## References

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