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Cognitive load during a walking task: a pilot study

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Introduction

- **Cognitive load (CL)** is the amount of mental effort required by the participant to perform a task¹
- **Dual task paradigm** showed that **gait is affected** when individuals are asked to walk and perform a cognitive task at the same time²
- **Older adults** may be **more affected** by dual-task walking due to **an increase of CL**³
- How can we **measure** the CL in a walking task ? **Objective** measure (physiological activity) / **Subjective** measure (felt effort)

Objectives

- Test the **feasibility** of our protocol
- Explore the cognitive load during a **simple vs. dual walking task** in **young and older adults**

Methods

Participants : 15 young adults (27.3 ans ± 4.9) and 15 older adults (62.1 ans ± 5.6)

Task : walking task, 4 conditions

- Standing (B)
- Walking (W)
- Subtracting while standing (S) (Number - 7)
- Subtracting while walking (SW)

Measurements : changes in hemoglobin oxygenated in the prefrontal cortex using **functional Near Infra-Red Spectroscopy (fNIRS)** + **NASA-TLX questionnaire** after each condition (W, S, and SW)



What is fNIRS ?

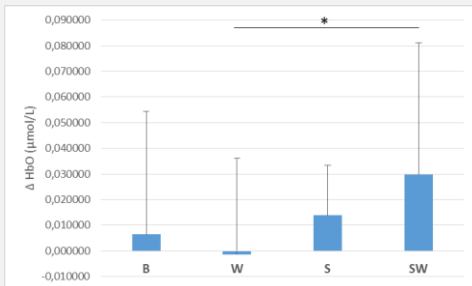
- Non-invasive **optical neuroimaging** technique
- Based on **hemodynamic response**
- Oxygenated and deoxygenated hemoglobin **absorb light** at different spectra
- **Indirect measurement** of brain activity
- Applied to a **walking task**



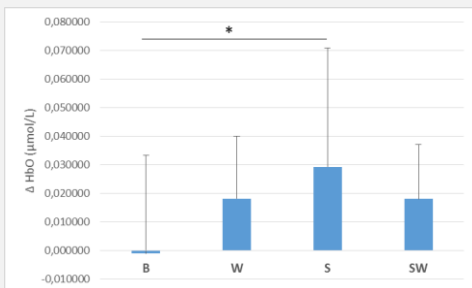
Results

fNIRS

Young adults



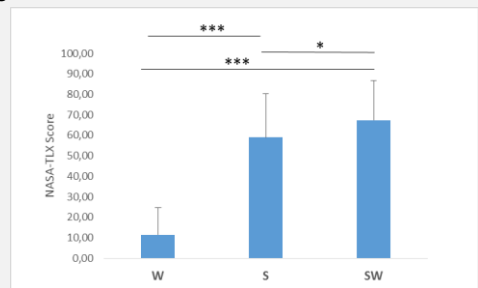
Older adults



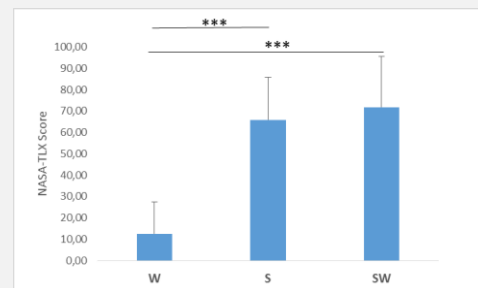
*, p<0.05

NASA-TLX

Young adults



Older adults



***, p<0.001 ; *, p<0.05

Discussion

- In young adults, objective measure showed an increased of CL in dual task walking (SW) compared to the walking task alone (W) → subjective measure of CL showed similar results
- In older adults, objective measure showed no significant differences between SW and W whereas they declared increased CL in dual task → it is possible that SW condition is too difficult for older adults and that the walking task alone may already requires cognitive resources⁵
- This pilot study highlights the importance of using both subjective and neurophysiological measures, to assess CL during a walking task, particularly in older adults

References

1. Ranchet, M., Morgan, J. C., Akinwuntan, A. E., & Devos, H. (2017). Cognitive workload across the spectrum of cognitive impairments: A systematic review of physiological measures. *Neuroscience & Biobehavioral Reviews*, 80, 516-537.
2. Beauchet, O., & Berrut, G. (2006). Marche et double tâche: définition, intérêts et perspectives chez le sujet âgé. *Psychol Neuropsychiatr Vieil*, 4(3), 215-25.
3. Hollman, J. H., Kovash, F. M., Kubik, J. J., & Linbo, R. A. (2007). Age-related differences in spatiotemporal markers of gait stability during dual task walking. *Gait & Posture*, 26(1), 113-119.
4. Park, D. C., & Reuter-Lorenz, P. (2009). The Adaptive Brain: Aging and Neurocognitive Scaffolding. *Annual Review of Psychology*, 60(1), 173-196.