

# EXPLORING THE CHALLENGES OF AVOIDING COLLISIONS WITH VIRTUAL PEDESTRIANS UNDER DUAL-TASK CONDITIONS AFTER MODERATE OR SEVERE TRAUMATIC BRAIN INJURY.

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## INTRODUCTION

- Traumatic brain injury (TBI) is a major cause of death and disability worldwide.<sup>1</sup>
- Despite good locomotor recovery,<sup>2</sup> individuals with chronic moderate-to-severe traumatic brain injury (m/sTBI) struggle to adapt their locomotion to environmental demands (e.g., avoiding obstacles).<sup>3</sup> Altered executive cognitive functions can further affect their dual-tasking ability.<sup>4</sup>
- The extent to which m/sTBI compromises collision avoidance strategies in response to moving pedestrians under dual- vs. single-task conditions remains unclear.

## OBJECTIVE

- To determine, in individuals with m/sTBI vs. healthy controls (CTLs), cognitive and locomotor dual-task costs (DTCs) associated with the simultaneous performance of an auditory cognitive task and a collision avoidance task involving virtual pedestrians (VRPs) approaching from a head-on direction.

## METHODOLOGY

- **Study design:** experimental study with repeated measure design.
- **Participants:** twelve individuals with m/sTBI (age=43.3±9.5 [mean±1SD]) and 12 healthy CTLs (age=41.8±8.3).

### INCLUSION

- Chronic m/s TBI
- Age: 18-55 years
- Walking speed: > 0.7 meters per second without AID
- Primary language: English or French
- Auditory and Visual acuity: Normal or corrected to normal

### EXCLUSION

- Neurological conditions (other than TBI for the TBI group)
- Rheumatological or orthopedic conditions interfering with locomotion

### Three task conditions (randomized)

Locomotor



Cognitive

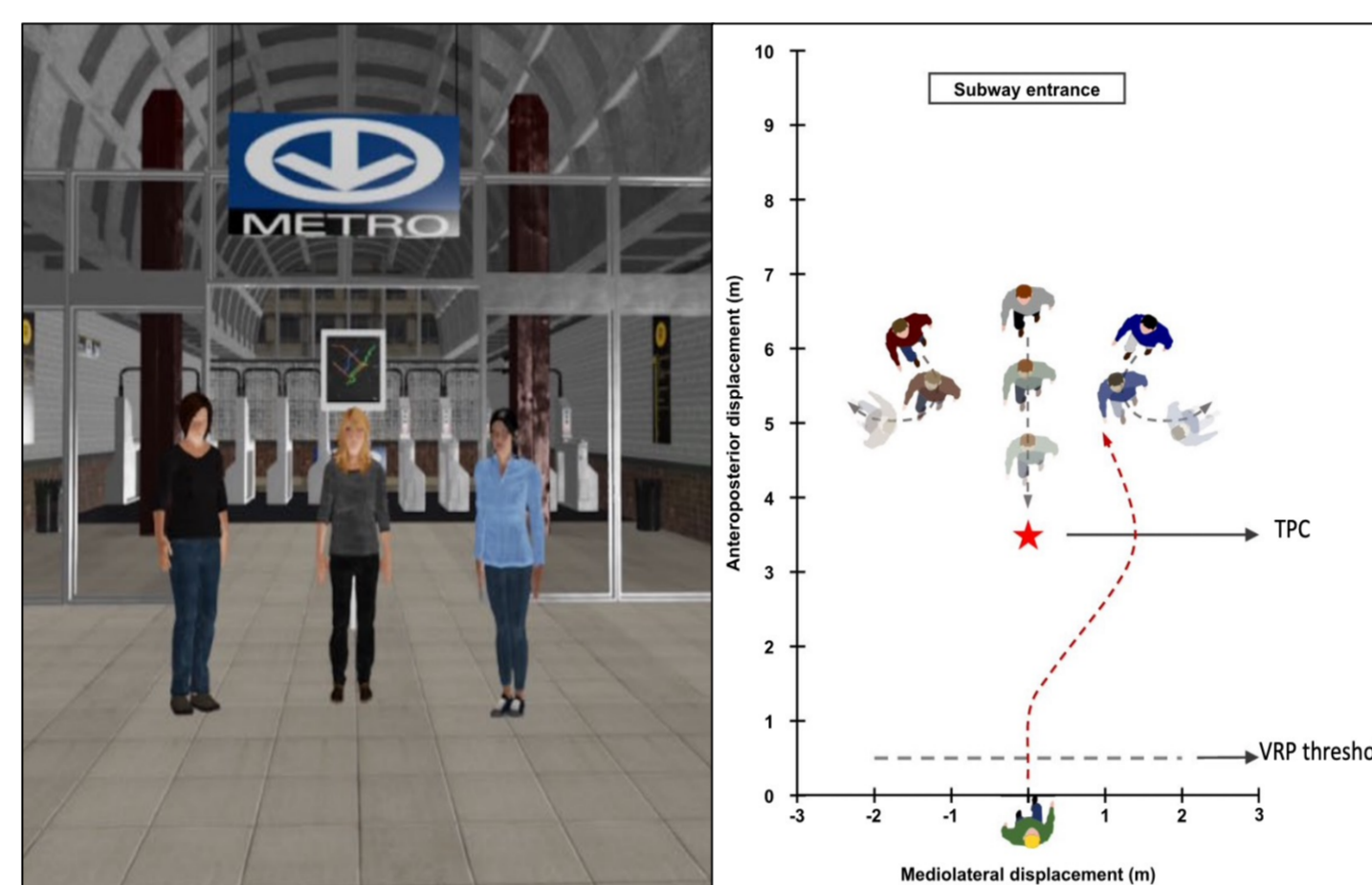


Locomotor + Cognitive



## Locomotor task

- 5 VRP conditions (left, middle, right, none and all back): only middle condition is presented.
- 6 trials per condition.
- Instructions: “Walk at a comfortable speed, towards the metro map and avoid any collision with an approaching virtual pedestrian, until the stop sign appears”. (1)



TPC – Theoretical Point of Collision



## Cognitive task

- Simple task: word “Cat” (or “Chat”) in a high or low pitch.
- Complex task: words “High” or “Low”. (“Haut” or “Bas”) in a high or low pitch
- 3 trials of 50 s for each task.
- Instructions: “Report the pitch of words as accurately as possible”. (2)

## Dual task

- Locomotor + cognitive task (simple and complex dual task).
- 30 trials per level of complexity.
- Instructions: “(1) at the same time (2).”

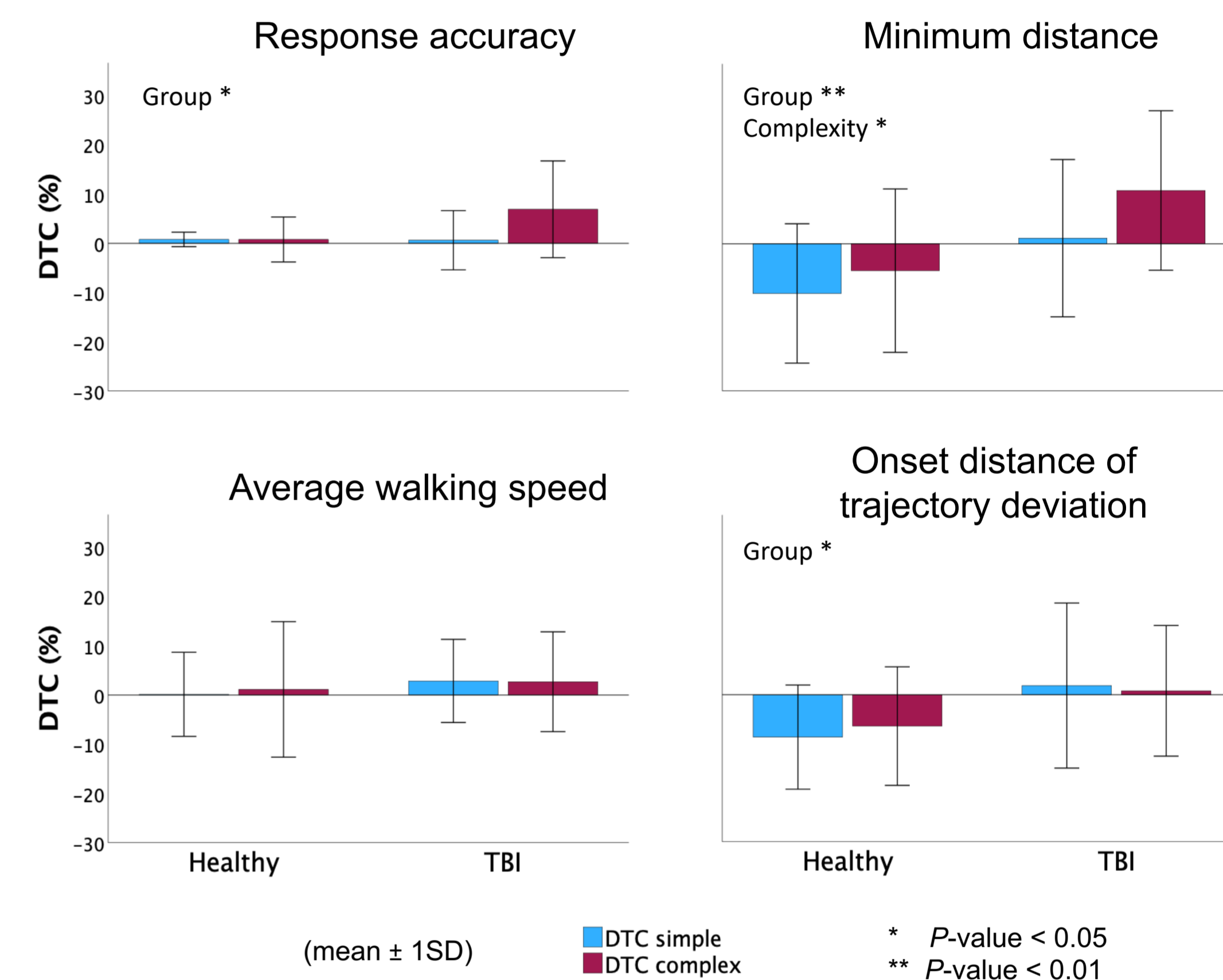
## Data analysis:

- Locomotor - Dual-task costs (DTC) in:
  - Average walking speed
  - Minimum distance between participant and VRP
  - Distance between participant and VRP at onset of medio-lateral trajectory deviation
- Cognitive - DTC in response accuracy

## Statistical analysis:

- Generalized Estimating Equations (GEE) with 1 within- (task complexity) and 1 between-subject factor (group). Significance level  $\alpha = 0.05$ .

## RESULTS



## CONCLUSIONS

- Preliminary findings suggest that m/s TBI individuals failed to modulate locomotor and cognitive performance in the simple dual-task condition and further experienced reduced performance in both domains during the complex dual-task, possibly increasing collision risk.
- Altered dual-task walking abilities in m/s TBI may contribute to poor community walking in this population.

## REFERENCES

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