



HAL
open science

Body movement strategies to initiate the crossing of a street in front of traditional and self-driving cars in young and older adults

Anne-Hélène Olivier, Antoine Marin, Joris Boulo, Aurélie Dommès, Gaetan Merlhiot, Nguyen-Thong Dang, Fabrice Vienne, Régis Lobjois, Viola Cavallo, Armel Crétual

► To cite this version:

Anne-Hélène Olivier, Antoine Marin, Joris Boulo, Aurélie Dommès, Gaetan Merlhiot, et al.. Body movement strategies to initiate the crossing of a street in front of traditional and self-driving cars in young and older adults. ISPGR 2022 - Congres on International Society of Posture & Gait Research, Jul 2022, Montréal, Canada. pp.1-1. hal-03921438

HAL Id: hal-03921438

<https://inria.hal.science/hal-03921438>

Submitted on 3 Jan 2023

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



BODY MOVEMENT STRATEGIES TO INITIATE THE CROSSING OF A STREET IN FRONT OF TRADITIONAL AND SELF-DRIVING CARS IN YOUNG AND OLDER ADULTS.

Anne-Hélène Olivier^{1*}, Antoine Marin¹, Joris Boulo¹, Aurélie Dommès², Gaëtan Merlhiot², Nguyen-Thong Dang², Fabrice Vienne², Régis Lobjois², Viola Cavallo², Armel Crétual¹
¹ Université Rennes 2, Inria, M2S, Rennes, France ² University Gustave Eiffel, Versailles, France *anne-helene.olivier@inria.fr



48% of pedestrians fatalities involve people aged 65 or more [1]

Deficits in street crossing behaviors in **Older Adults (OA)** [2, in a simulator]:
 ↘ walking speed, ↗ of risky decisions

Young adults'(YA) strategies : the head initiates the crossing movement, followed by the shoulders, elbows, wrists, hips, knees and ankles [3, in front of a TV screen]
Head rotation is not a key factor to predict street crossing [4, using real street condition]

Self-driving vehicles = new challenges on the road[5]
 Identifying pedestrians' motion invariants could be a key to safety

To investigate body movement strategies performed before crossing the street in OA wrt. YA in complex mixed traffic

METHODS

Between-group design

30 YA, 21-39yo

30 OA, 68-81yo

Task: cross (or not) a virtual two-way street by walking in a simulator
 Conditions: 120 street crossings trials in the following conditions

2 TYPES OF VEHICLES (4 possibilities) :
 Conventional and/or Self-driving cars (always stopping, letting the pedestrian cross)

5 TYPES OF GAPS (1,2,3,4, and 5s) **2 SPEEDS (30 or 50 km/h)**

Motion capture using Vicon System (120Hz), Full Body 27 markers

PRELIMINARY RESULTS & DISCUSSION

- ❖ **Delays in body movement initiation (12 YA-16 OA)**
 - YA & OA: Top-down sequence to initiate the street crossing in accordance with [3] Head → Shoulders → Hips → Toe
 - Very small effect of aging and traffic conditions (resp. $p < .001$, $\eta^2 = .04$, $p < .005$, $\eta^2 = .01$)
- ❖ **Body segment angles profiles (29 YA-20 OA)**
 - **Variability in left-right rotation angles profiles of the head, hips, shoulders**
 - **Forward tilt profile of the trunk more consistent**

1 HEAD
Mean : -0.51s
Sd : 0.36s

2 SHOULDERS
Mean : -0.33s
Sd : 0.23 s

3 HIPS
Mean : -0.21s
Sd : 0.21s

➡ **Forward head motion & trunk tilt angle promising predictors of street crossing**
 ➡ **Consistent body behavior between YA and OA to initiate street crossing**

Analyses:

- **Comparison of the delays to initiate the crossing movement for head, shoulders and hips with respect to the feet**
- **Hierarchical clustering on body segments angles profile 2s before the initiation of crossing by the toe to identify specific groups of behavior.**

