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]


Identifying pedestrians' motion invariants could be a key to safety

Methods:
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)
- 2 SPEEDS (30 or 50 km/h)

5 TYPES OF GAPS (1, 2, 3, 4, and 5s)

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

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.

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

Forward head motion & trunk tilt angle promising predictors of street crossing

Consistent body behavior between YA and OA to initiate street crossing