



HAL
open science

Pedestrian collision avoidance on narrow sidewalk: a meeting between psychology and virtual reality

Cléo Deroo, Angélique Montuwy, Béatrice Degraeve, Jean-Michel Auberlet, Anne-Hélène Olivier, Marie-Axelle Granie

► To cite this version:

Cléo Deroo, Angélique Montuwy, Béatrice Degraeve, Jean-Michel Auberlet, Anne-Hélène Olivier, et al.. Pedestrian collision avoidance on narrow sidewalk: a meeting between psychology and virtual reality. TRB 2019 - Annual Meeting on Transportation Research Board, Jan 2019, Washington, United States. hal-02396553

HAL Id: hal-02396553

<https://univ-rennes.hal.science/hal-02396553v1>

Submitted on 31 Jan 2020

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.

PEDESTRIAN COLLISION AVOIDANCE ON NARROW SIDEWALK: A MEETING BETWEEN PSYCHOLOGY AND VIRTUAL REALITY

Context: NARROW SIDEWALKS

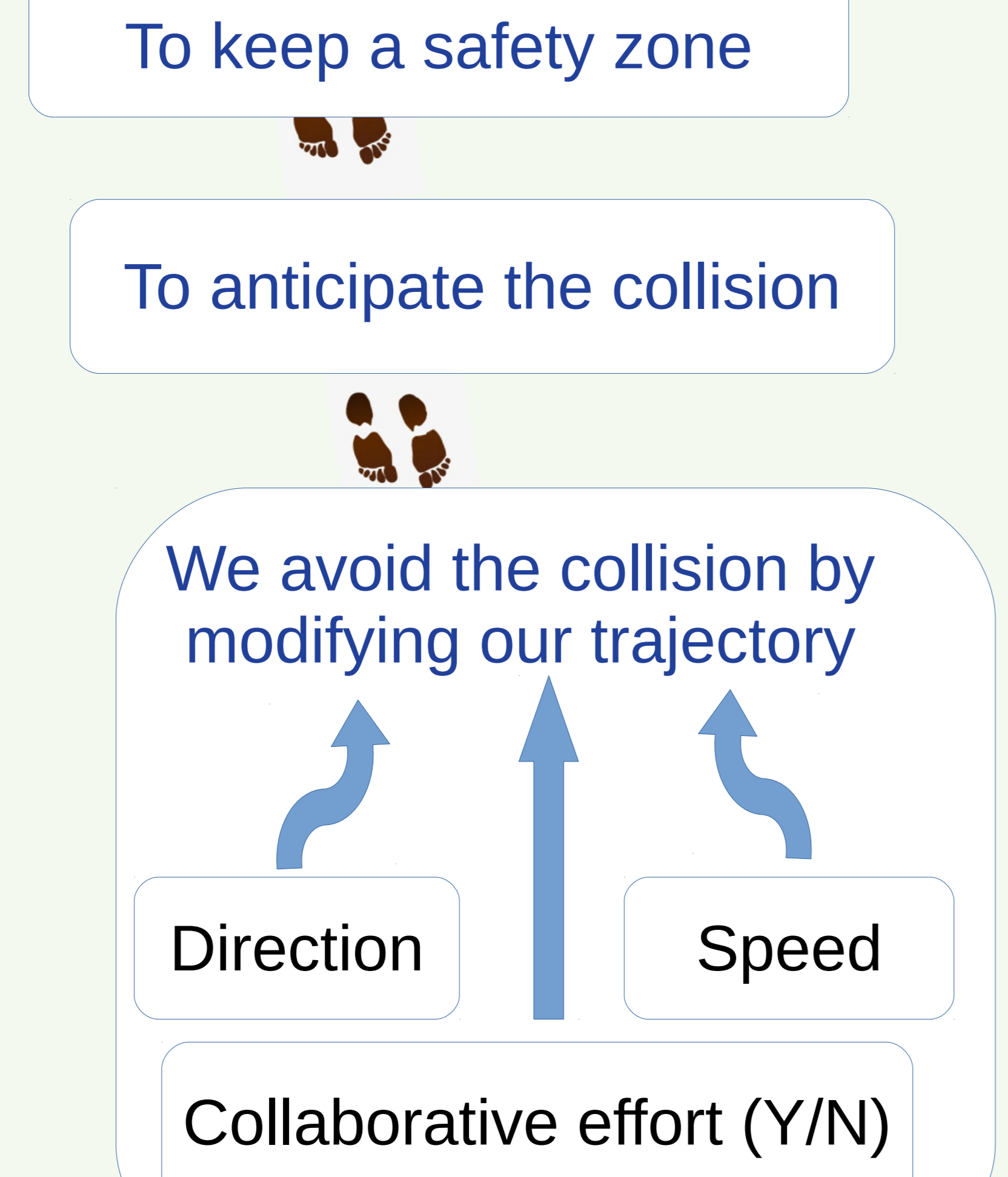
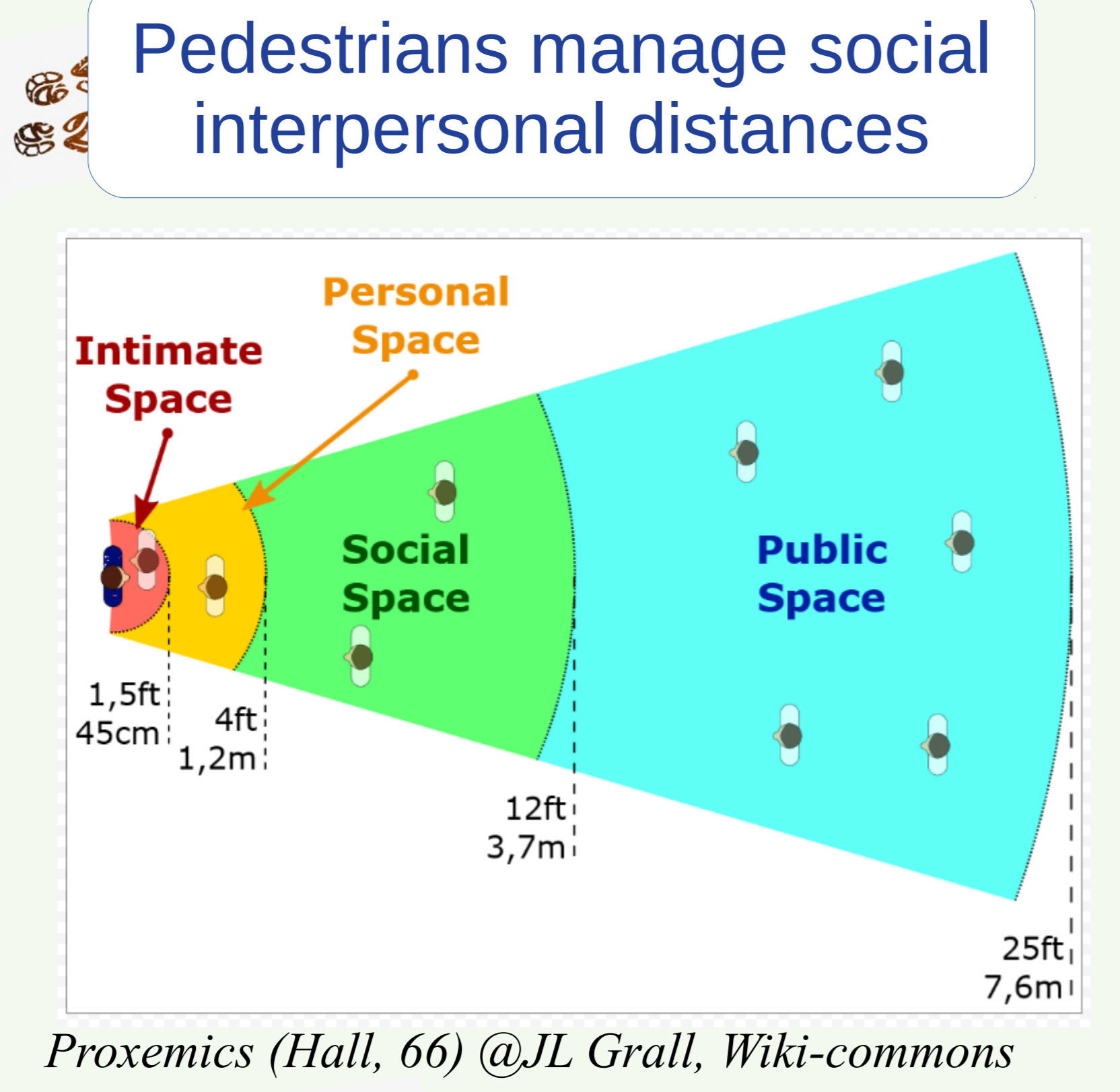


Encounter of two pedestrians is impossible
 → one has to step down and he is exposed to the road traffic
 → It can be seen as an URBAN JOUSTING



Goal:
 to simulate a social virtual pedestrian (non player character) in order to study this kind of situation in virtual environment

Problem:
 why do we choose to step down or stay on the narrow sidewalk when we encounter a pedestrian walking in the opposite way ?

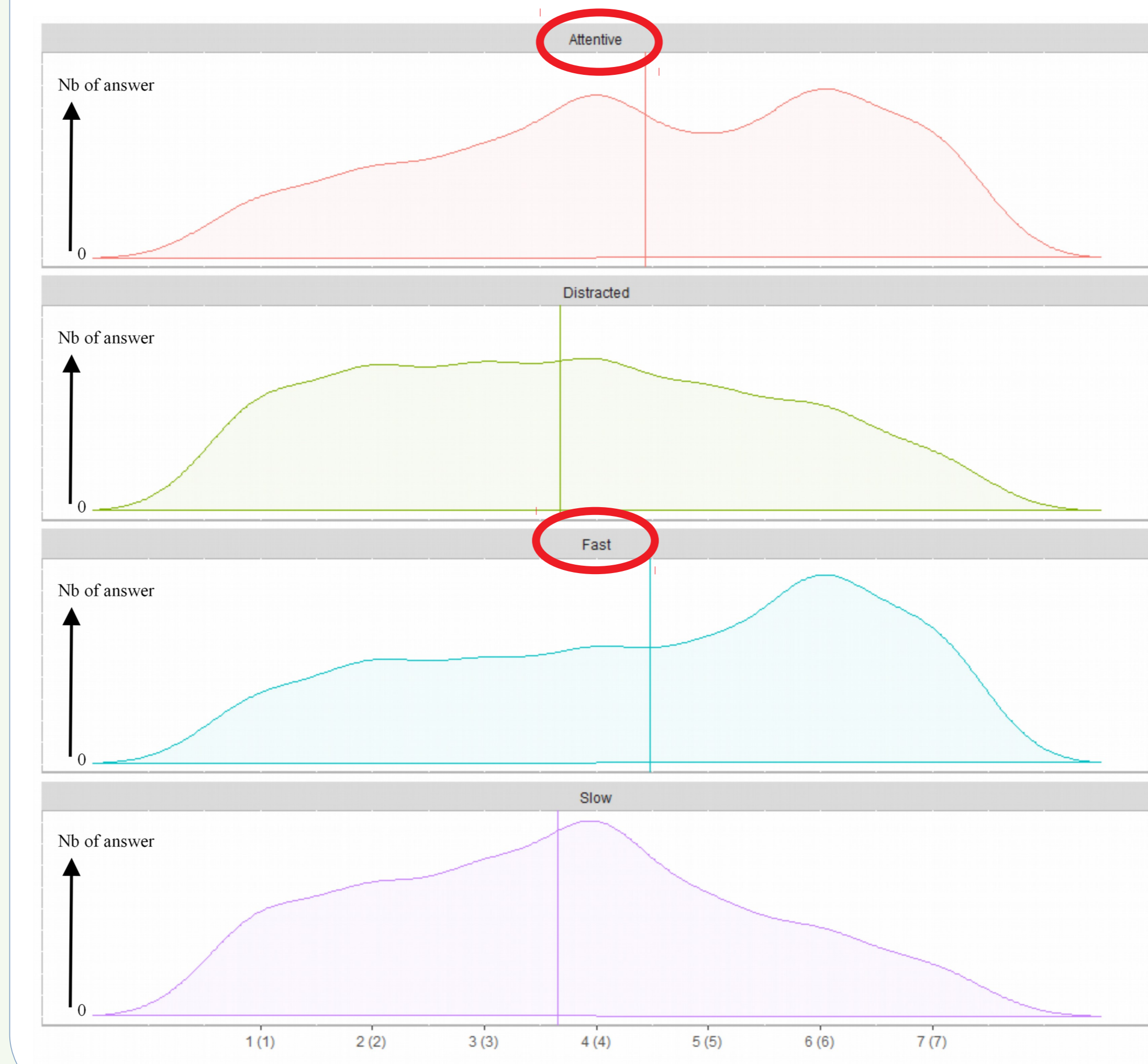


Personal characteristics (psychological and physical)



Impact of 3 personal factors were studied
 Speed (fast – slow)
 Sex (Male – Female)
 Distraction (texting – non texting)

First Experiment – Results



→ Influence of speed and attention
 Pedestrian is expected to step down when
 * he walks fast,
 * he is attentive
 → For the participants, no gender effects

Perception model for the virtual pedestrian

→ ORCA Model used.
 different types of collision avoidance (anticipative, reactive)
 → Collision avoidance behaviors are a function of the walking speed, the detection time

Cléo DEROO^{1,2}
 Jean-Michel AUBERLET¹
¹ Université Paris-Est, COSYS, LEPSIS, IFSTTAR, Paris, France
² Telecom ParisTech, Paris, France
⁵ M2S lab, University Rennes 2 - ENS Rennes – UEB, Rennes, France

Angélique MONTUWY^{1,3}
 Anne-Hélène OLIVIER⁵
³ Centrale Nantes, Nantes, France
⁴ Lille Catholic University, OCeS, Lille, France
⁶ Univ Lyon, IFSTTAR, TS2, LESCOT, Lyon, France

Béatrice DEGRAEVE⁴
 Marie-Axelle GRANIE⁶

First Experiment – Questionnaire

→ 64 videos of pre-jousting, before any modification of trajectory
 * 8x8 counterbalanced videos
 → Participants told who was to step down: pedestrian at left or at right in the jousting with a Likert scale.
 → Participants said why the virtual pedestrian stepped down (speed, sex, distraction) with Likert scales
 >80 participants

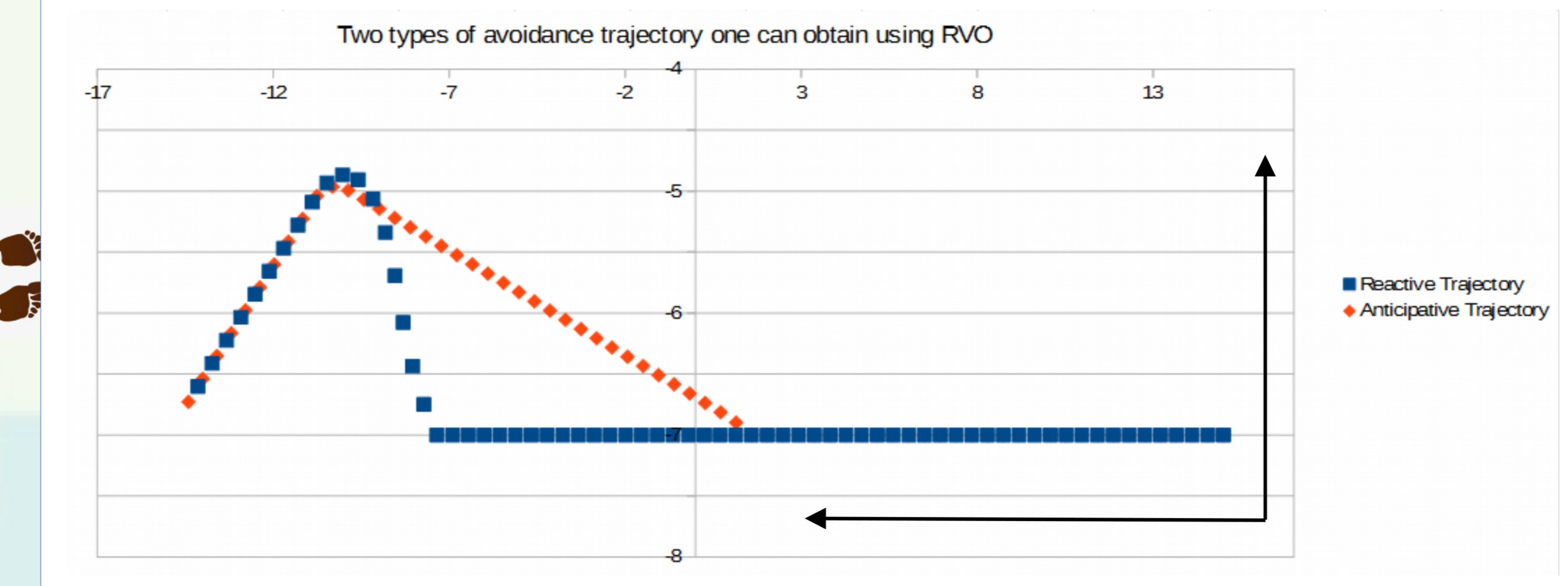
2nd Experiment – Questionnaire

→ 64 videos of complete jousting with the new model.
 * 8x8 counterbalanced videos
 * One of 8 videos is a fake video (opposite of the model result)
 → Participants said if the jousting is credible >80 participants

Social Perception Model

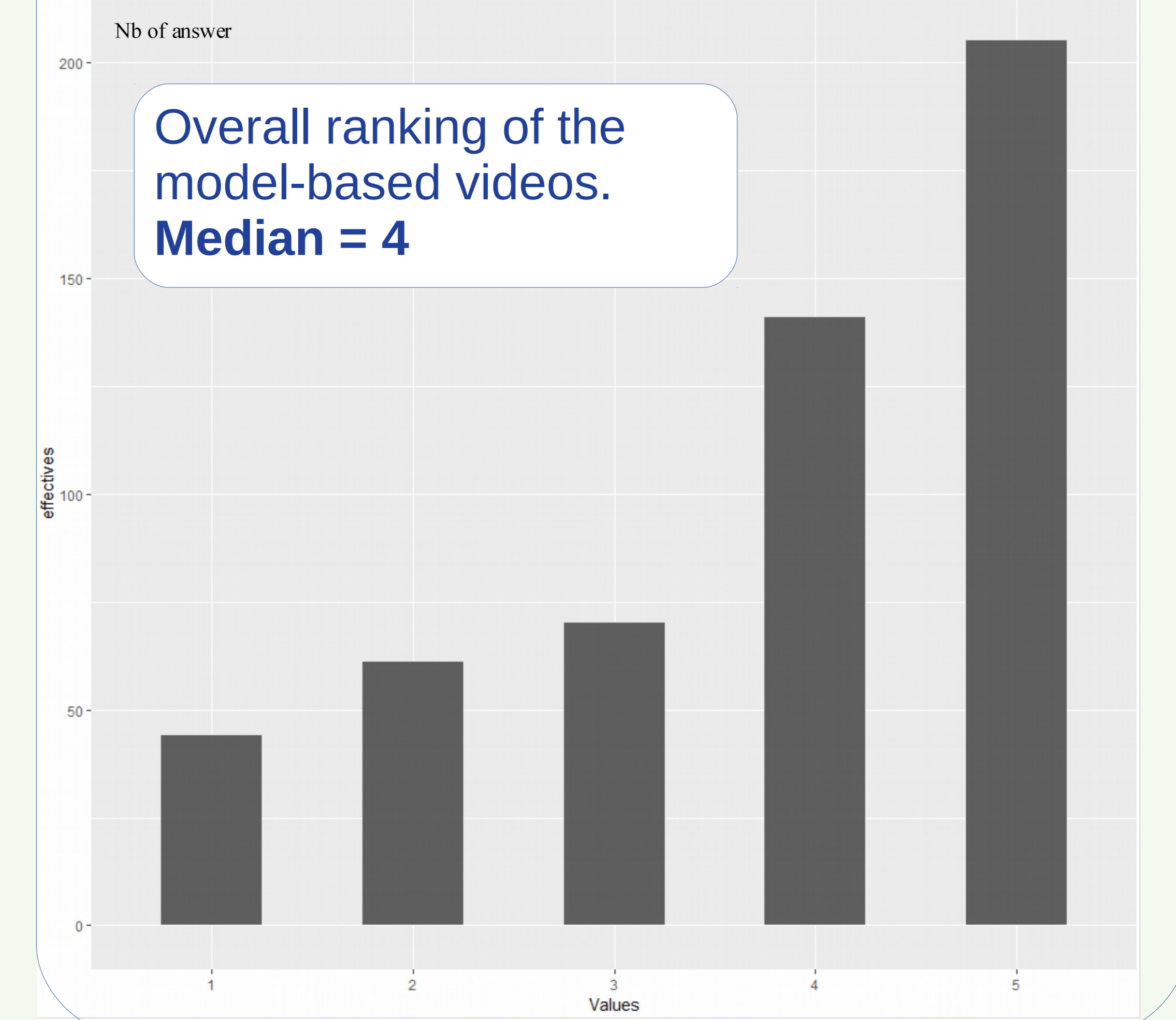
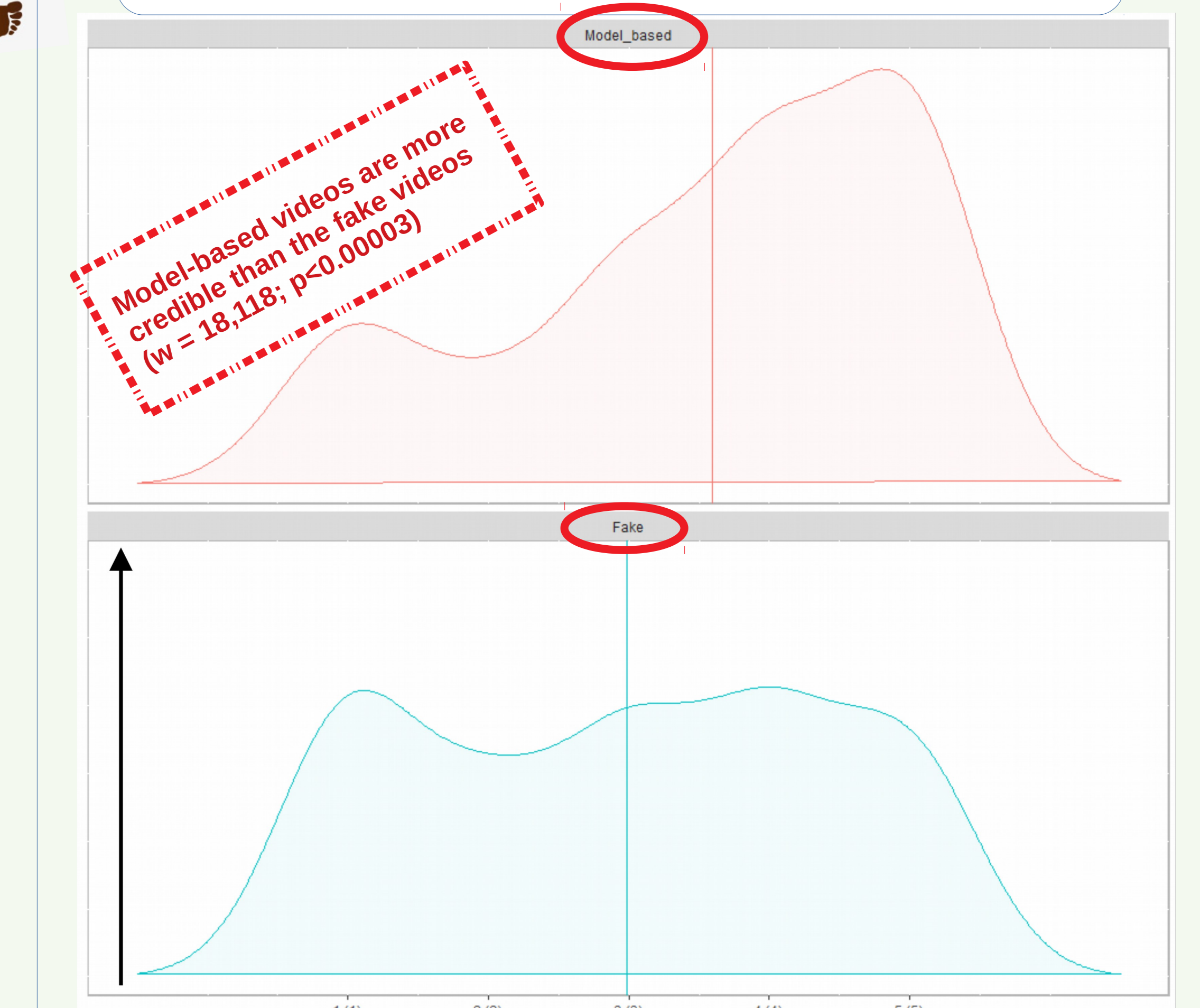
→ Speed and attention influence the decision to step down from the narrow sidewalk
Assumption: speed and attention increase the detection time in the ORCA model. **Detection time is then a score.**
 → Virtual pedestrian decides to step down if his detection time is greater than the other pedestrian involving in the jousting
 N.B.: the virtual pedestrian sees pedestrian in the public space, and detects him in the social space

Collision avoidance behaviors simulation (Orca model)



2nd Experiment – Results

credibility of model-based videos and fake videos according to the subjects' answers



Discussion

→ To use Social Pedestrian Non Player Characters in VR environment is feasible
 → Needs to take into account the empowerment/authority