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

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

Context: NARROW SIDEWALKS



Paris ©AH Olivier 2018 Paris ©AH Olivier 2018

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

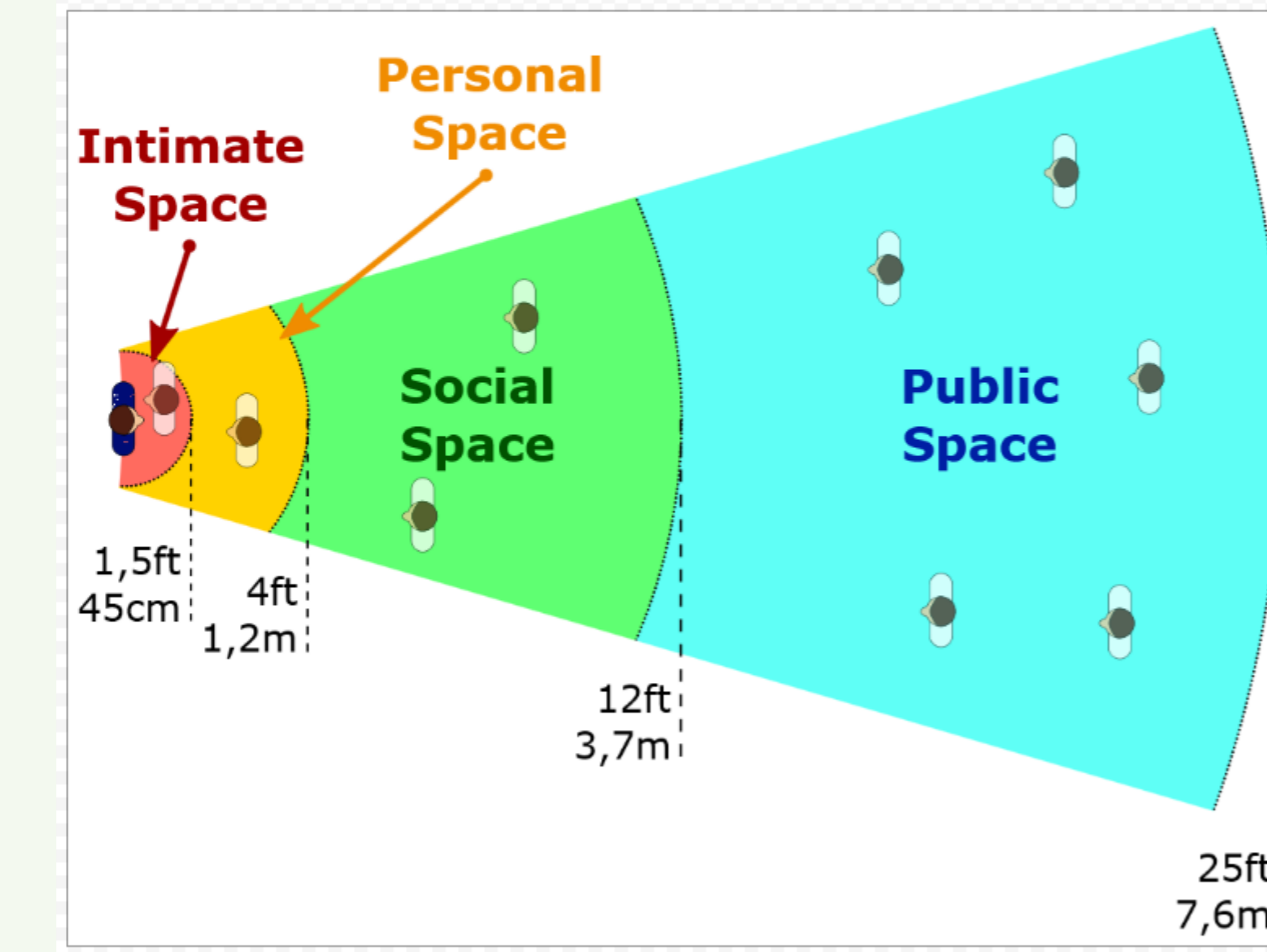
Waster Jousting (https://en.wikipedia.org/wiki/Water_jousting)
 Medieval Jousting (<https://en.wikipedia.org/wiki/Jousting>)



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 ?

Pedestrians manage social interpersonal distances



Proxemics (Hall, 66) @JL Grall, Wiki-commons

To keep a safety zone

To anticipate the collision

We avoid the collision by modifying our trajectory

Direction

Speed

Collaborative effort (Y/N)

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

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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

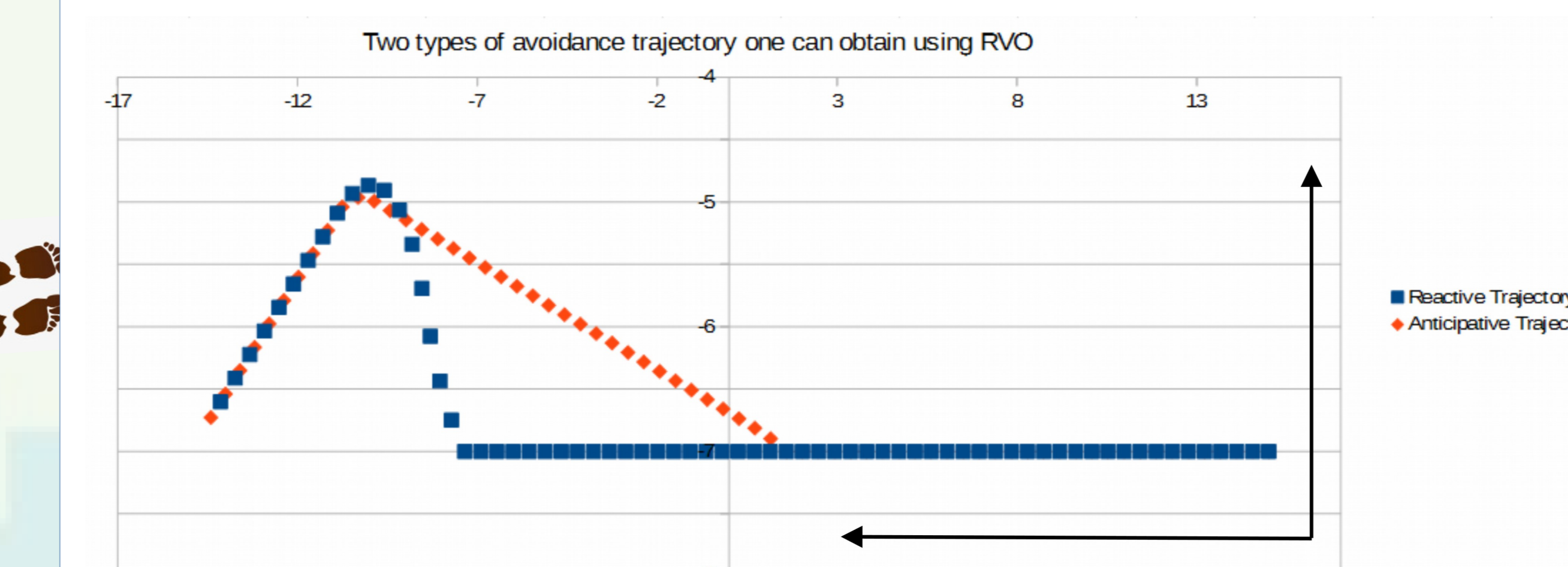
→ Speed and attention influence the decision to step down from the narrow sidewalk

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

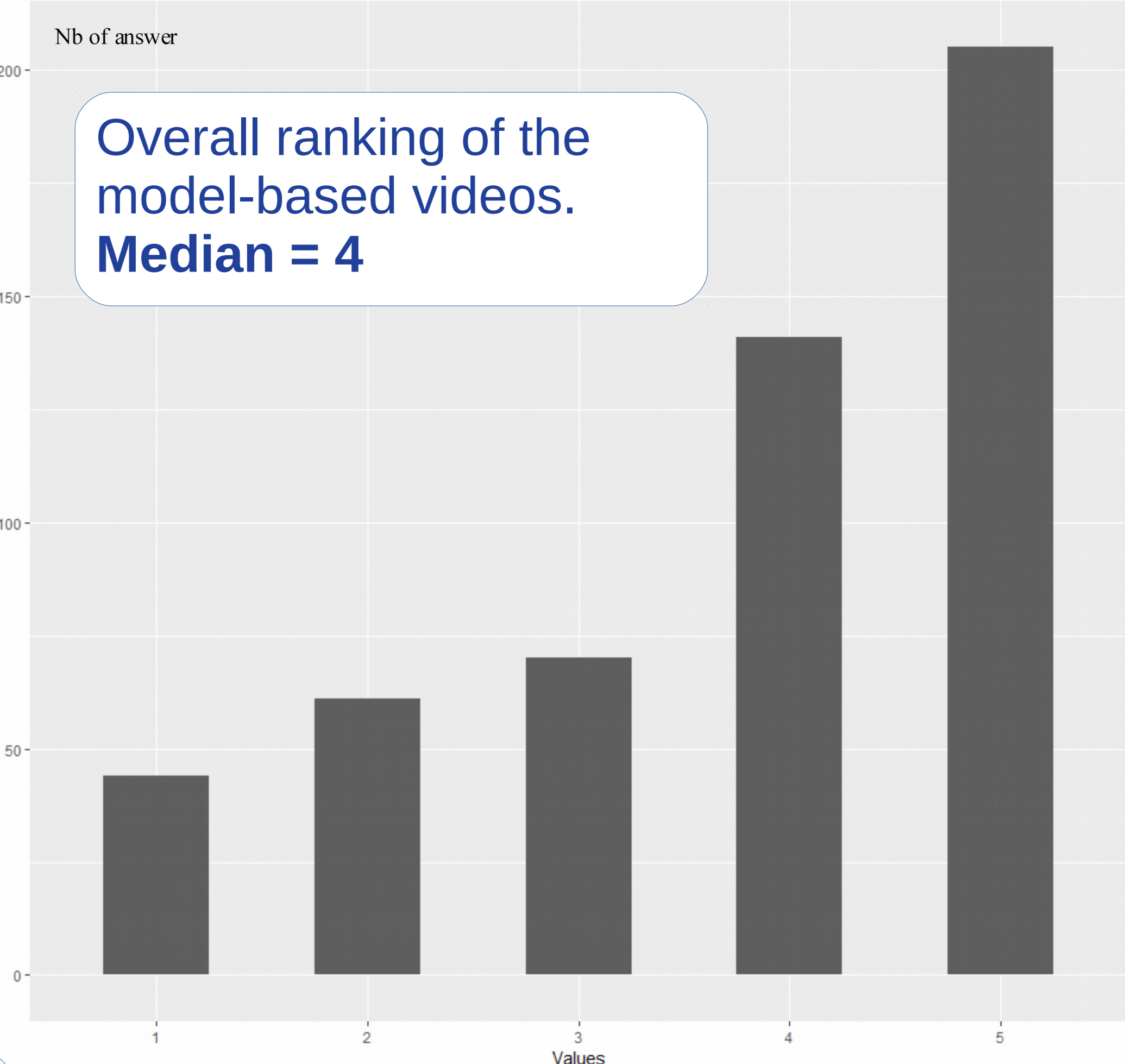
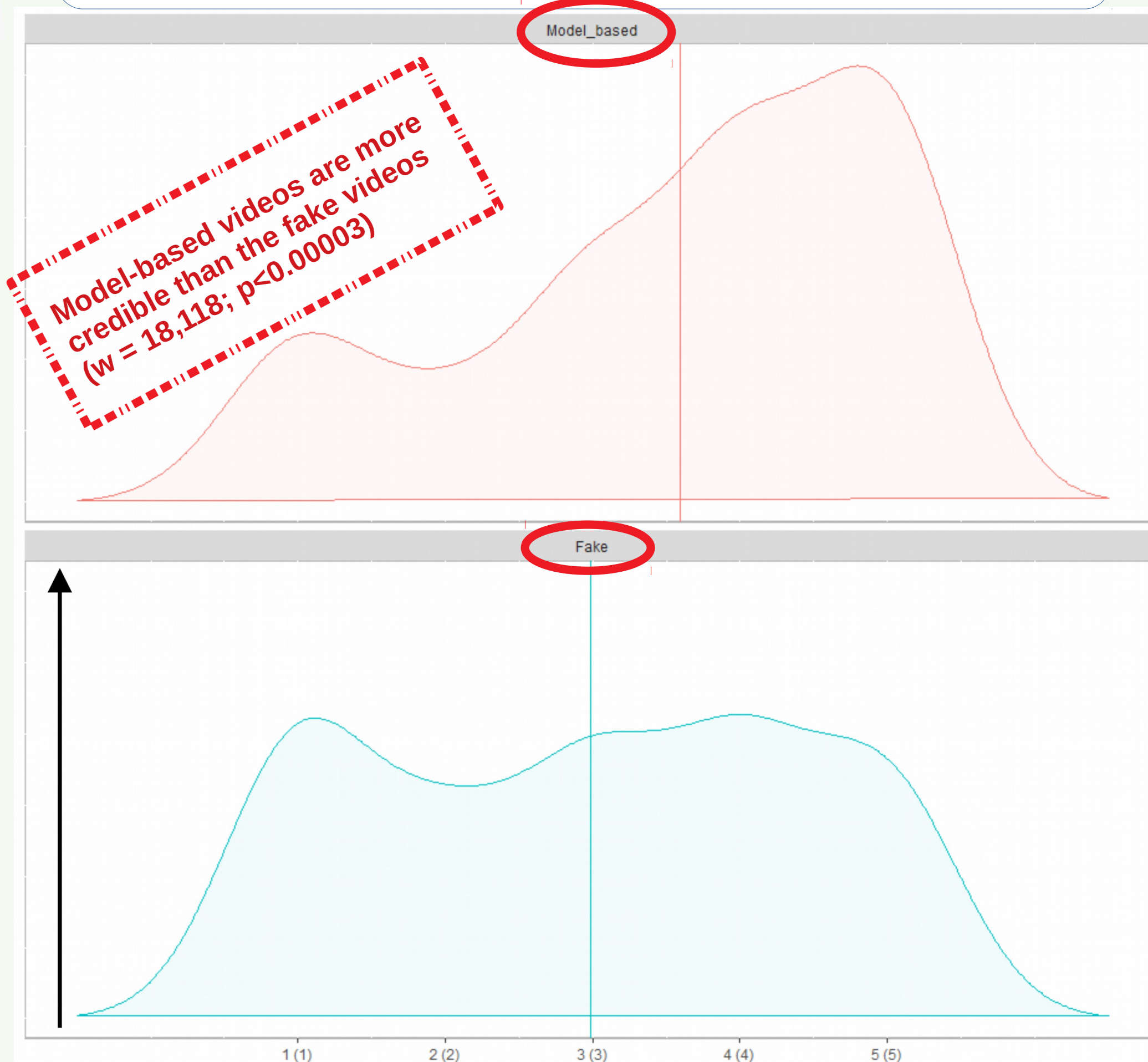
N.B.: the virtual pedestrian sees pedestrian in the public space, and detects him in the social space

Collision avoidance behaviors simulation (Orca model)



2nd Experiment – Results

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



Overall ranking of the model-based videos.
Median = 4

Discussion

→ To use Social Pedestrian Non Player Characters in VR environment is feasible

→ Needs to take into account the empowerment/authority