connected automated driving.eu

AV user acceptance & communication requirements of other road users when interacting with AVs

Dr Ruth Madigan, ITS, University of Leeds

CityMobil2
CITIES DEMONSTRATING AUTOMATED ROAD PASSENGER TRANSPORT

CARTRE and SCOUT are funded by the European Union Horizon 2020 Work Programme

Acknowledgements

University of Leeds: Professor Natasha Merat, Dr Tyron Louw

DLR German Aerospace: Marc Dziennus, Anna Schieben

La Rochelle: Tatiana Graindorge, Matthieu Graindorge, Erik Ortega, Nicolas Malhéné

Lausanne: Anne Koymans Mellano, Philippe Vollichard

Trikala: Evangelia Portouli, Giannis Karaseitanidis, Xristina Karaberi,

CityMobil2
CITIES DEMONSTRATING AUTOMATED ROAD PASSENGER TRANSPORT

SEVENTH FRAMEWORK PROGRAMME

www.citymobil2.eu

connected automated driving.eu

CityMobil2 Demonstration Locations

La Rochelle, France:

- November 2014 to April 2015
- Route 1.7km including 7 station stops
- 204 participants
- Mainly operating in shared space

Lausanne, Switzerland

- April to August 2015
- Route 1.6km including 6 station stops
- 145 participants
- Mainly operating on EPFL campus

Trikala, Greece

- September 2015 to February 2016
- Route 2.5km including 8 station stops
- 315 participants
- Mainly operating in dedicated lane

connected automated driving.eu

Interviews, Focus Groups, On-Site Surveys & Video Analysis

(N = 24)

(N = 20)

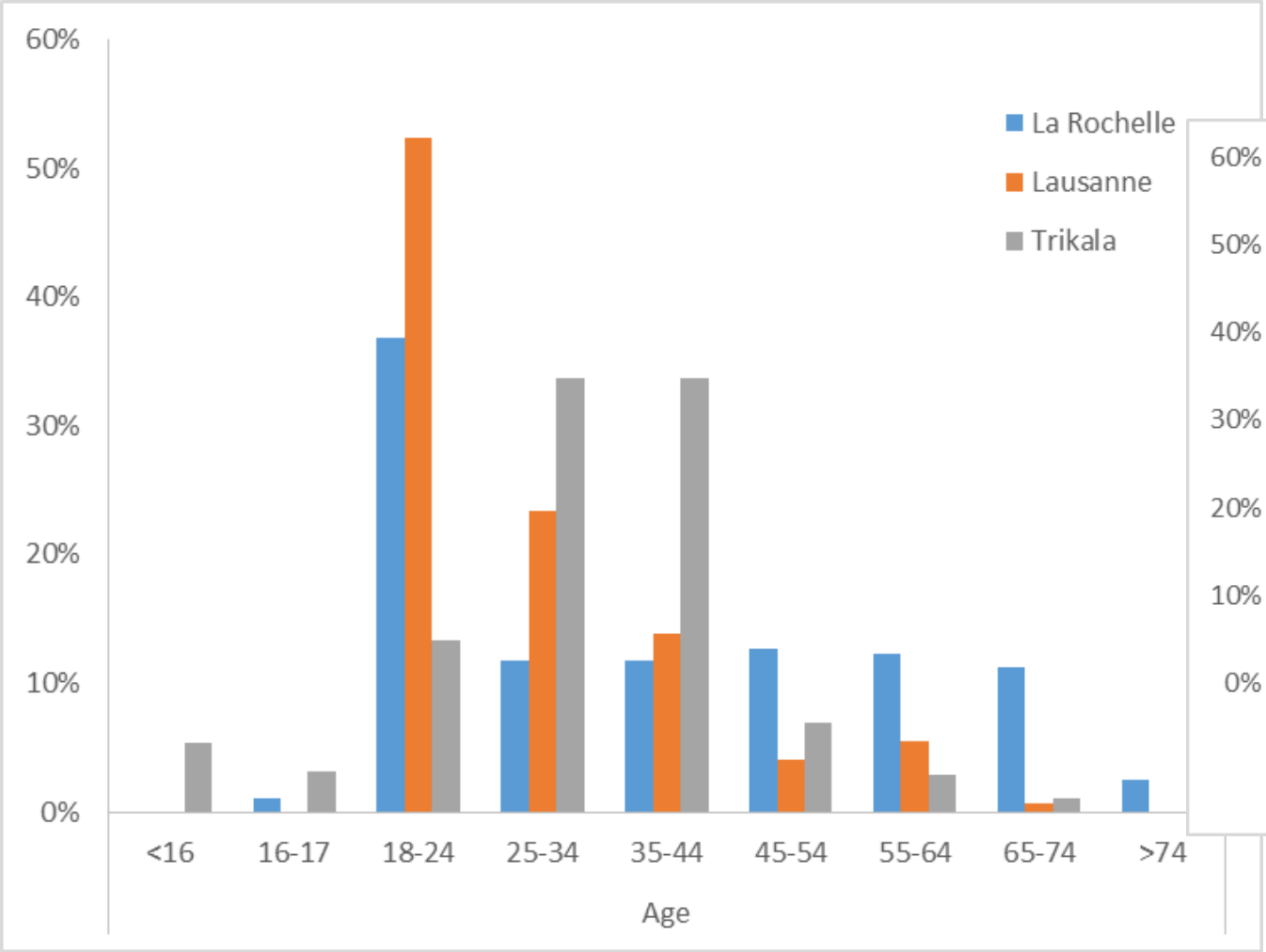
(N = 349)
La Rochelle = 204
Lausanne = 145
Trikala = 315

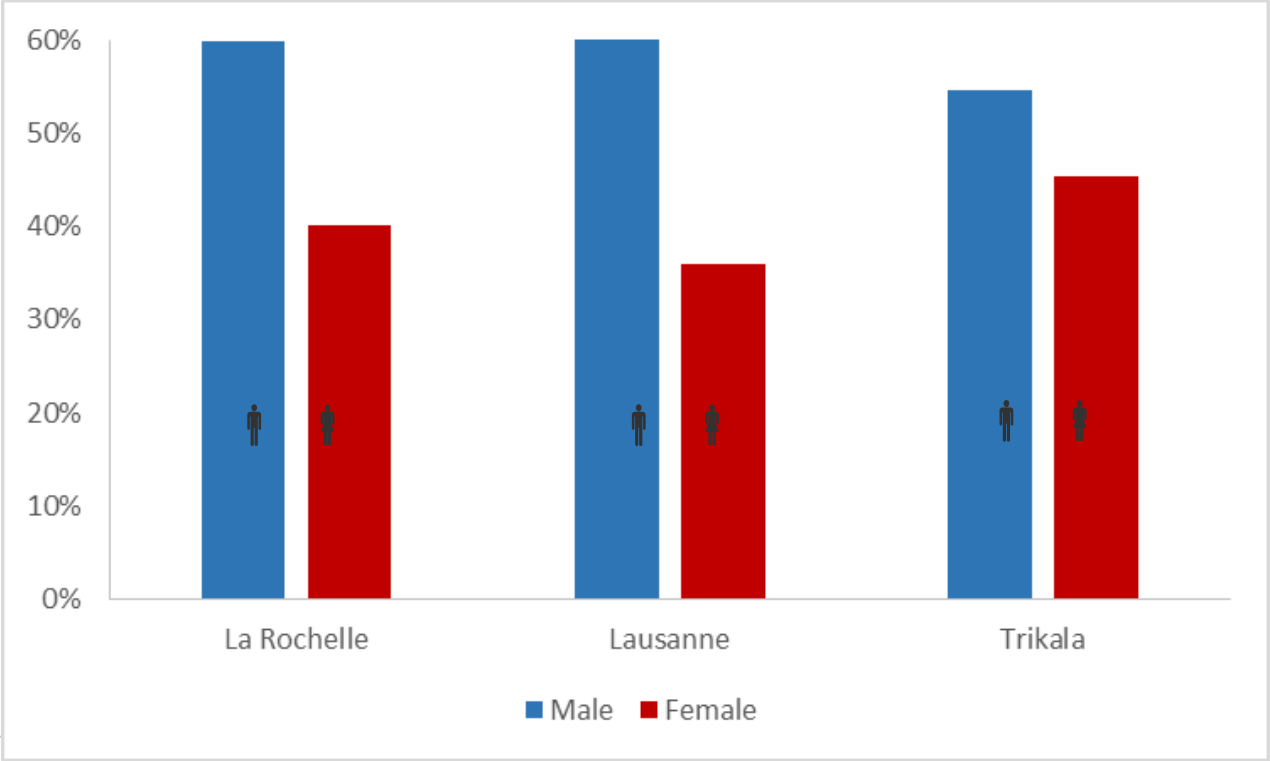
Questionnaire Study

- 42 questions
  - 8-10 minute completion time

- Demographics & travel patterns
- Interaction & communication requirements (Merat et al., under review)
- Unified Theory of Acceptance and Use of Technology (Madigan et al., 2017)

Population Characteristics



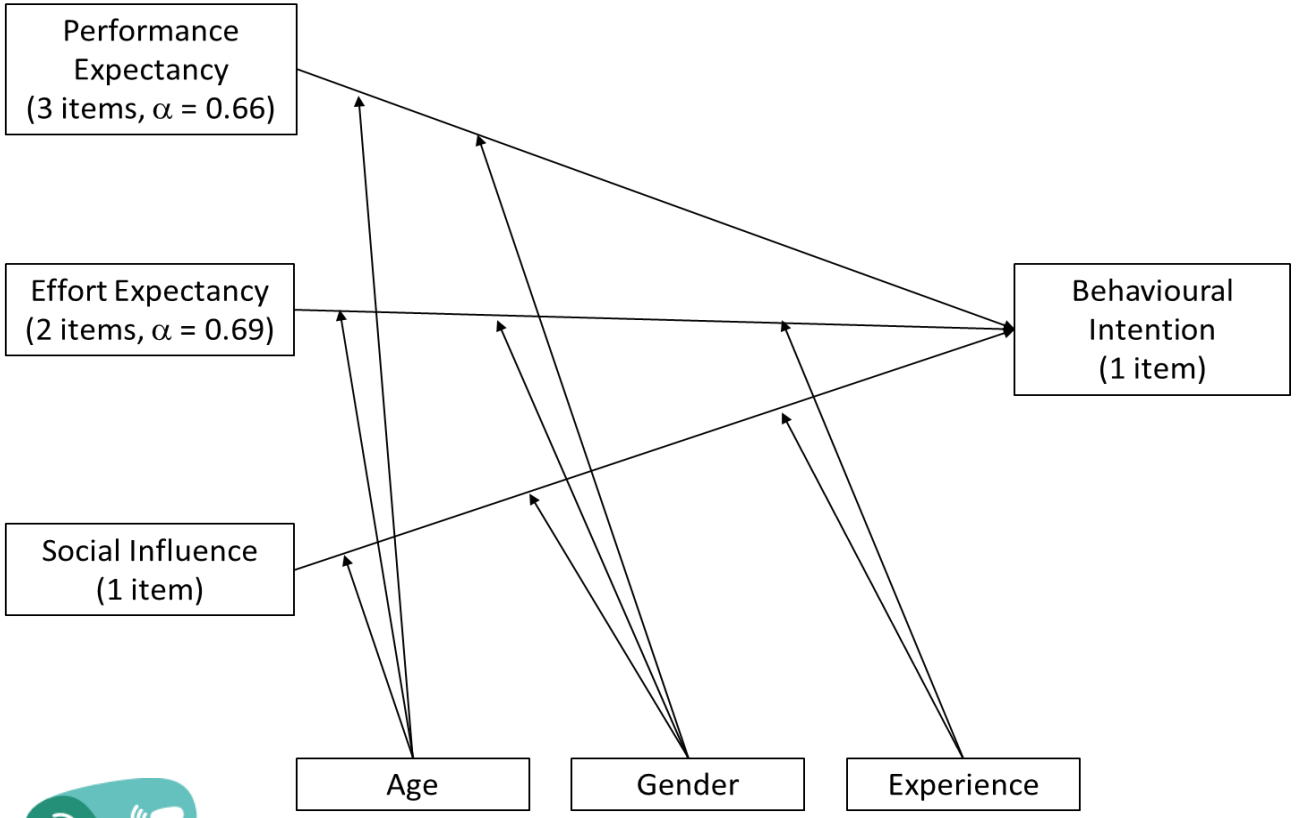


Key Questions

- What factors influence users' behavioural intentions to use ARTS?
- How do cyclists and pedestrians feel (safety/priority) about the ARTS?
- What information do cyclists & pedestrians require from the ARTS?

What factors influence intentions to use ARTS? La Rochelle & Lausanne

- Applying the Unified Theory of Acceptance and Use of Technology (UTAUT)



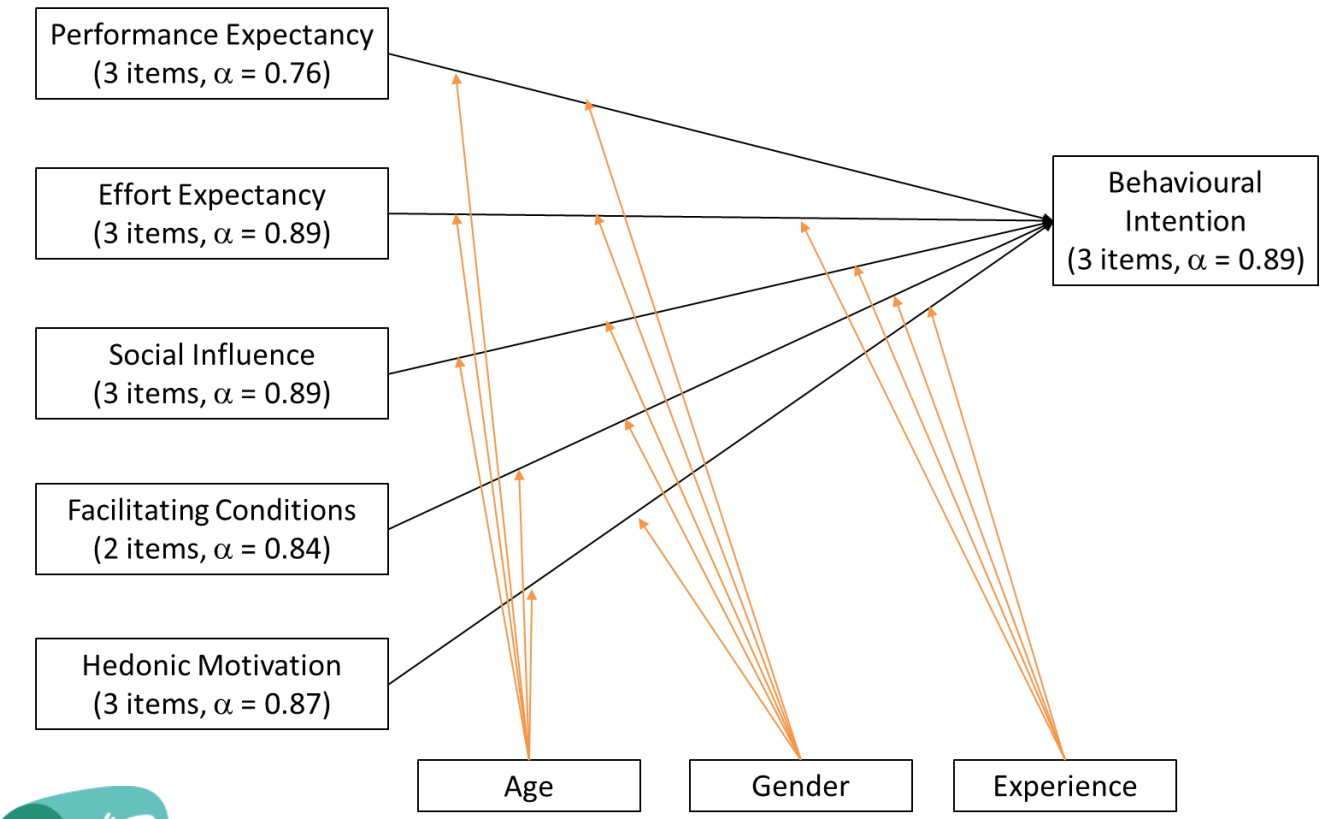
- Predictors account for 22% variance in behavioural intentions to use an ARTS
- **Performance expectancy** strongest predictor
- Effort expectancy least important

connected automated driving.eu

*Madigan et al. (2016). Acceptance of Automated Road Transport Systems (ARTS): an adaptation of the UTAUT model. *Transportation Research Procedia,* 14, 2217-2226

What factors influence intentions to use ARTS? Trikala

- Applying the Unified Theory of Acceptance and Use of Technology (UTAUT)

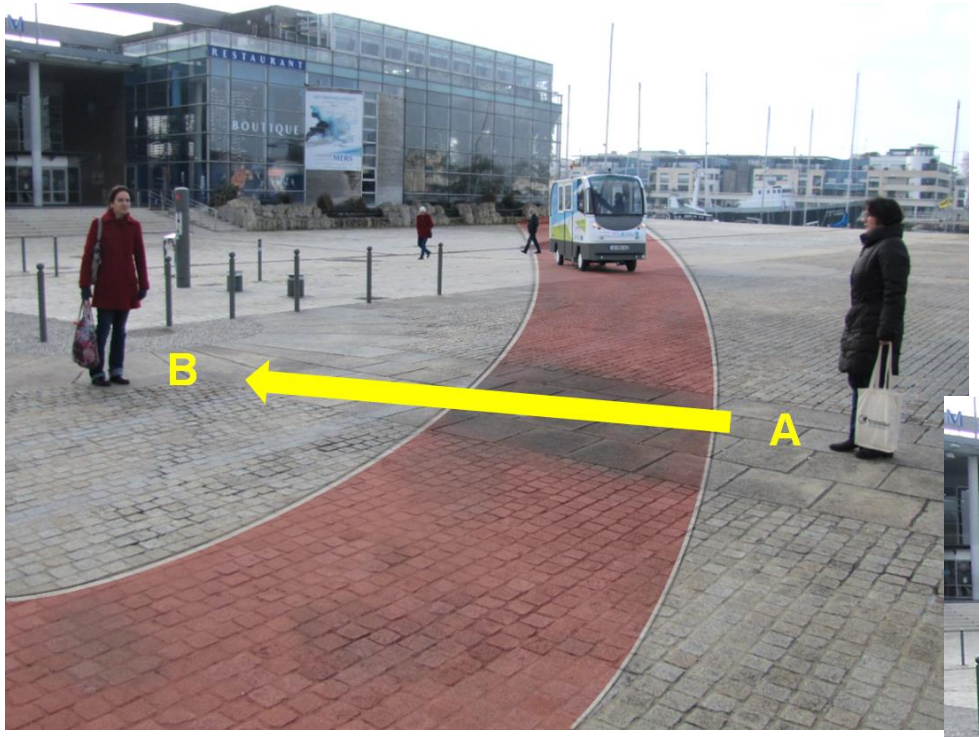


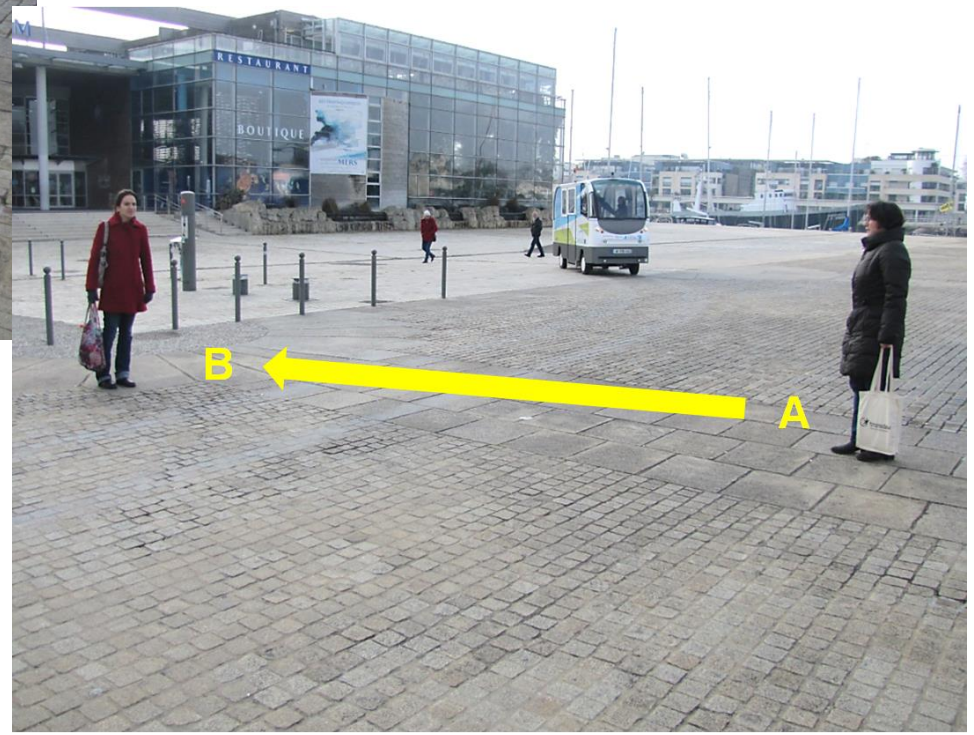
- Predictors account for 58.3% variance in behavioural intentions to use an ARTS
- **Hedonic Motivation** the strongest predictor
- **Performance expectancy**, **social influence** and **facilitating conditions** also important
- Effort expectancy not significant

connected automated driving.eu

*Madigan et al. (2017). What influences the decision to use automated public transport: Using UTAUT to understand public acceptance of automated road transport systems. *Transportation Research Part F,* 50, 55-64

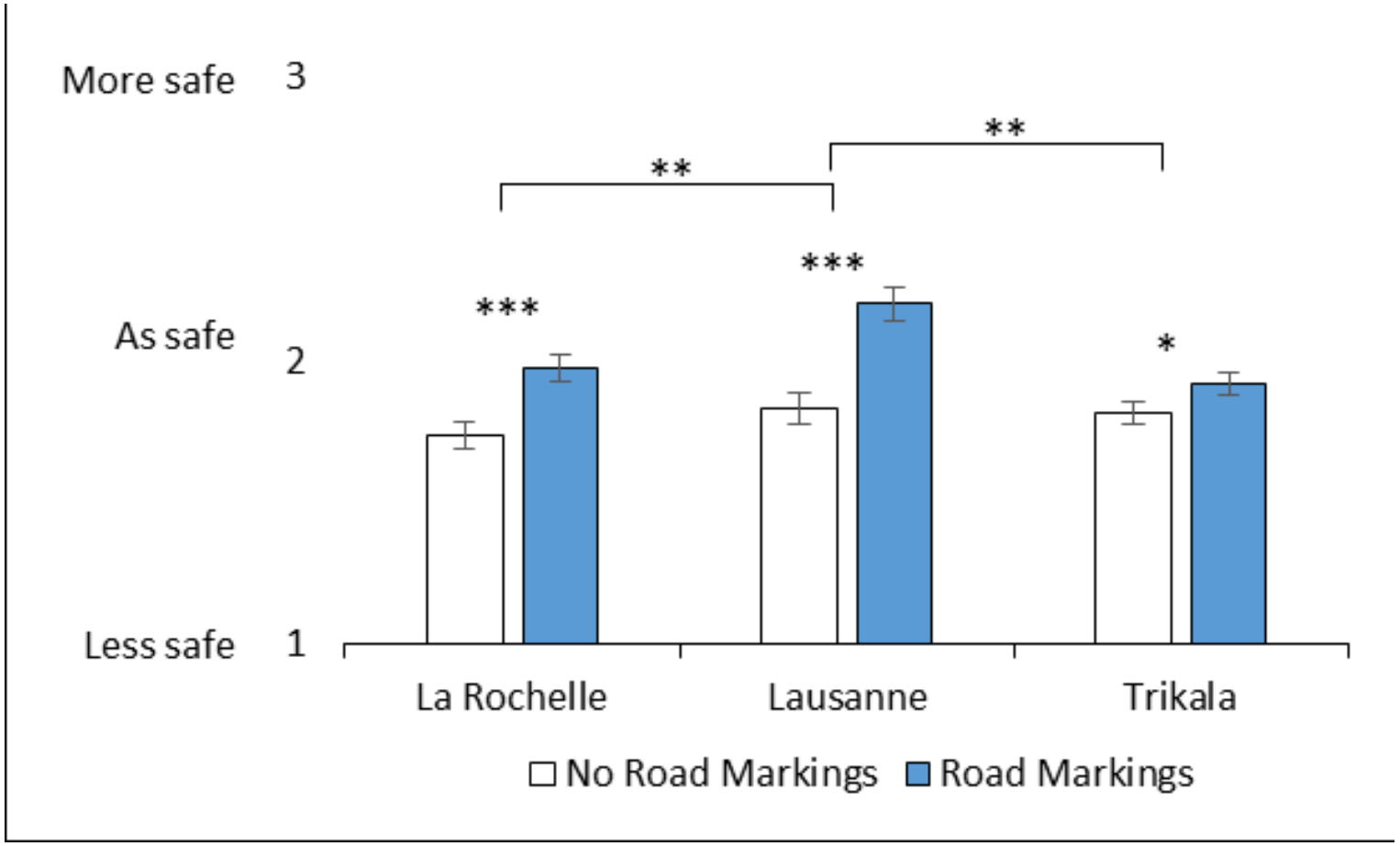
Opinions of Other Road Users: Safety and Priority?





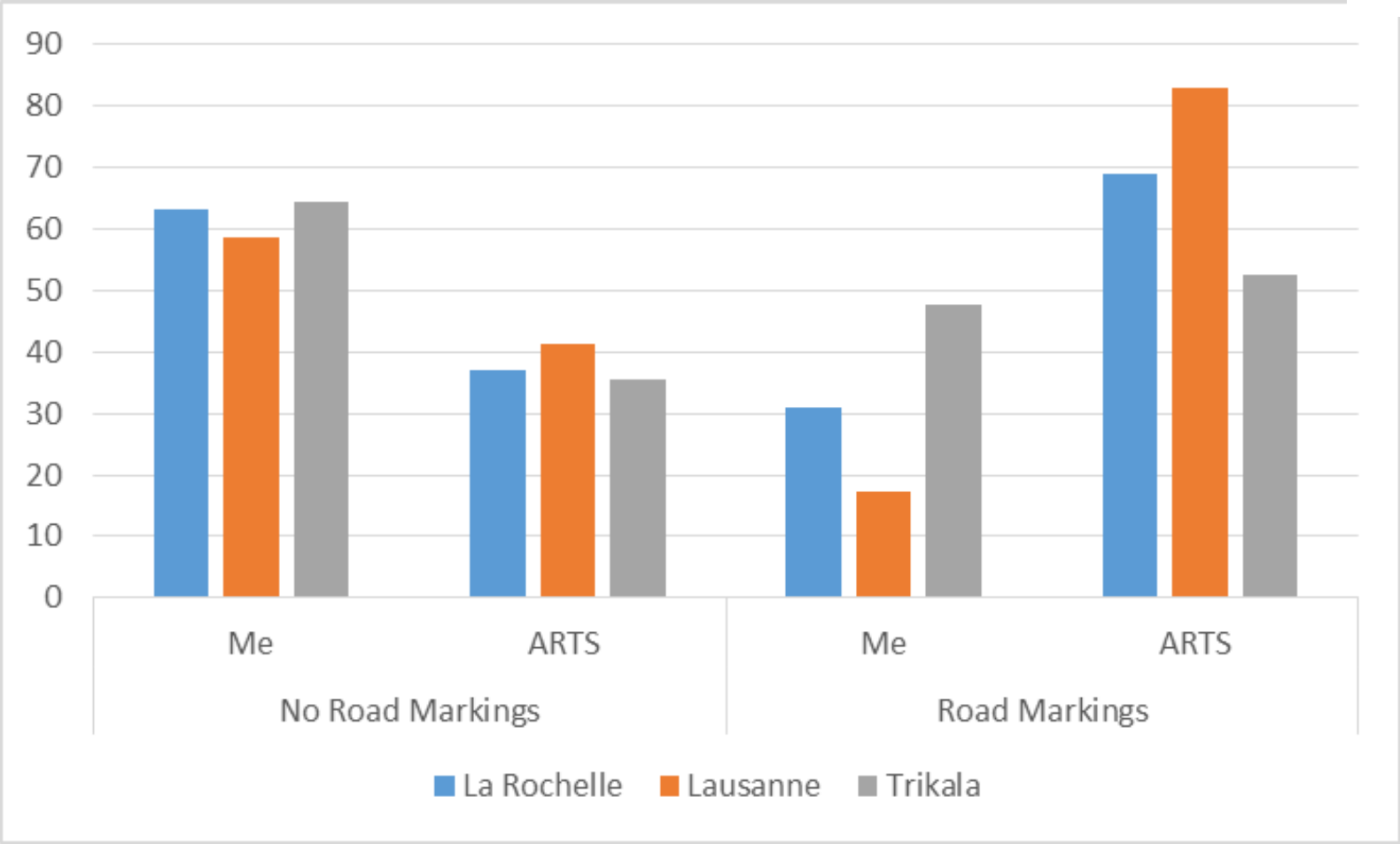
Images from La Rochelle

Do you feel more safe?



*Merat et al. (under review). What externally presented information do VRUs require when interacting with fully Automated Road Transport Systems in shared space?

Who has priority?



*Merat et al. (under review). What externally presented information do VRUs require when interacting with fully Automated Road Transport Systems in shared space?

What information?

- Information required on whether other road users had been **detected**
- Information also desired on ARTS **stopping**, **turning**, and **starting** intentions
- Explicit information on speed of travel not required
- No effects of Road Markings
- Preferences for how information should be presented differed across locations
  - Audio spoken word / Audio signals
  - Visual lights / Visual text

Focus Group: La Rochelle

Priority

- **Direction of travel** not obvious
- Not sure who had priority
- Would prefer **demarcations**
- Not sure if the vehicle can **identify hazards**?
- Suggested use of horns and lights for **detection and communication**

*Merat et al. (2016). Road users' comprehension of, and attitudes towards, Automated Road Transport Systems (ARTS) in an urban environment. CityMobil2 Project Deliverable 18.1, European Commission. See: http://www.citymobil2.eu/en/Downloads/Public-deliverables/

Other Focus Group Comments

- **Visibility:** Colour maybe too discrete, brighter colour to make it easy to see / identify.
  - In La Rochelle yellow would be more suitable to fit in with other public transport modes.
- **Sound:** Lack of engine noise a problem for its localisation, especially for the visually impaired.
- **Speed:** Too slow, but probably ok in a shared space
- Better for **tourists** than commuters.

Summary & Conclusions

- User acceptance of public AVs likely to be influenced by enjoyment of use, how well they perform, social norms, & facilitating infrastructure

- As the deployment of automated vehicles become commonplace, the views of other road users should be sought
  - In particular, understanding how VRUs (and other vehicles) interact and communicate with a ‘driverless’ vehicle is important
  - This study shows that VRUs definitely want some information and (at the moment) prefer the ARTS to be in a dedicated space.
  - They assume they have priority in a shared space.

connected automated driving.eu

Thank you

CARTRE and SCOUT are funded by the European Union Horizon 2020 Work Programme