INTERNATIONAL FEDERATION OF PEDESTRIANS

Agenda item 4 : Assessment of the safe deployment of automated vehicles in road traffic: human factors
Optical and Audible Signals in DAS and ADS Vehicles

Automated vehicles' signalling and human factors

Justine Anken, Policy Advisor,
International Federation of Pedestrians (IFP)

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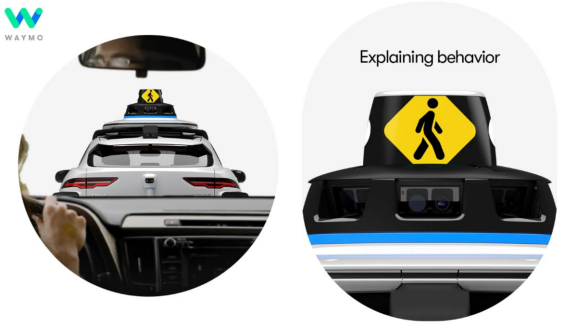
Context : Recognizability and communication

The current discussions at WP.1 on automated vehicles signalling address two issues:

1) The potential need to be **recognized** by :
   - Other road users
   - Enforcement officers

https://www.motortrend.com/news/mercedes-benz-turquoise-lights-sae-level-3-automated-driving/

2) The potential need to **communicate** with other road users:
   - On its intended actions (notably to pedestrians)
   - On prompt anticipated responses from other road-users (notably from pedestrians)



https://gagadget.com/fr/ai/335276-waymo-a-mis-au-point-un-systeme-de-communication-visuelle-entre-les-voitures-sans-conducteur-et-les-humains/

Recognizability purpose

The IFP does not oppose to the implementation of a (coloured) light signal indicating the automation status of the vehicle, provided that pedestrians are not required to alter their behavior in response to this signal and that there are no legal implications for pedestrians.

Predicting the impact on other road-users (including pedestrians) remains difficult and needs further research.

Communication purpose

Existing formal and implicit signals

→ Remaining on automated vehicles

Informal signals

→ Used as a justification to develop specific signaling for automated vehicles

Research has demonstrated that this mode of communication is not readily comprehended as commonly assumed and does have negative consequences.

- Pedestrians pay rather attention to the speed of the car
- Easily leading to misinterpretation

→ It is not a safe and reliable mode of communication.

M. A. Brewer, K. Fitzpatrick, J. A. Whitacre, and D. Lord. Exploration of pedestrian gap-acceptance behavior at selected locations. Transportation research record, 1982(1):132–140, 2006.

AlAdway, D., Glazer, M., Terwilliger, J., Schmidt, H., Domeyer, J., Mehler, B., Reimer, B., &Fridman, L. (2019, June). Eye contact between pedestrians and drivers. Proceedings of the 10th International Driving Symposium on Human Factors in Driver Assessment, Training, and Vehicle Design, Santa Fe, New Mexico, June 24-27, 2019.

Automated vehicles signals to communicate with pedestrians

IFP is convinced that it is not possible to create a system that would be intuitively and universally understood by all pedestrians without significantly increasing their cognitive burden

Mercedes-Benz F015 Concept (Daimler, 2015), Nissan IDS Concept (Nissan Motor Corporation, 2015), Semcon Smiling Car Concept (Semcon, 2016), Volvo Concept 360 (Volvo Cars, 2018), Smart EQ ForTwo Concept (Daimler, 2017), Drive.ai Concept (Drive.ai (2), 2018), and Jaguar/Land Rover Virtual Eyes Concept (Jaguar Land Rover, 2018).

The current system being tested include and their issues for pedestrians:

- **Text:** ability to read, language,
- **Colours:** confusion on the targeted road users who is to stop, who is to go?
- **Symbols (faces, arrows, hands)** : not easily understandable.
- **Projections on the road**: Complexity to be universally understood.
- **Audio signalling :** Raising noise levels

Signals may be impacted by the weather condition (snow, rain, sunlight)

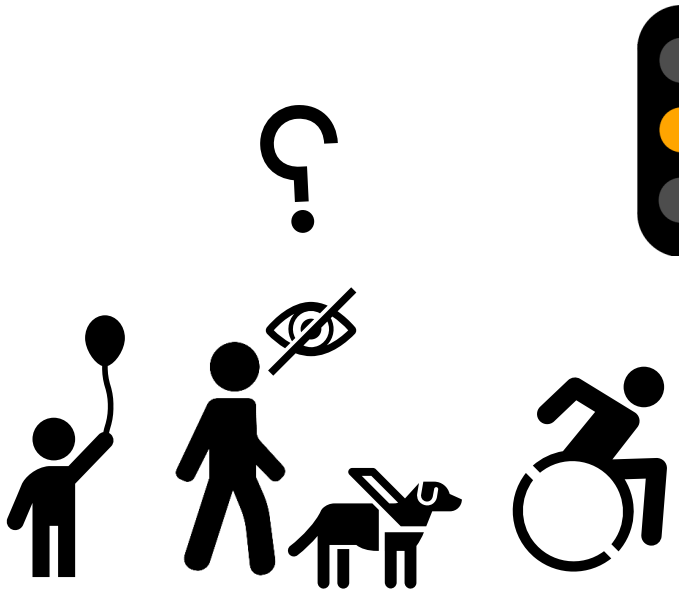
Image: Fridman, L., Mehler, B., Xia, L., Yang, Y., Facusse, L.T., Reimer, B. (2017). To walk or not to walk: Crowdsourced assessment of external vehicle-to-pedestrian displays.

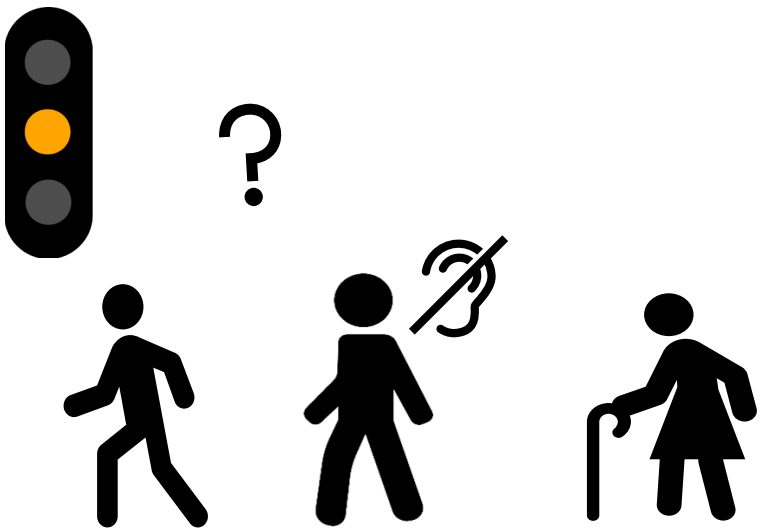
Signals are being tested in simple and/or artificial conditions far from the real-life road traffic complexity.

Image: Löcken, A., Golling, C., & Riener, A. (2019, September). How should automated vehicles interact with pedestrians? A comparative analysis of interaction concepts in virtual reality.

Image: Habibovic, A., et al. "Communicating intent of automated vehicles to pedestrians." Frontiers in psychology (2018): 1336

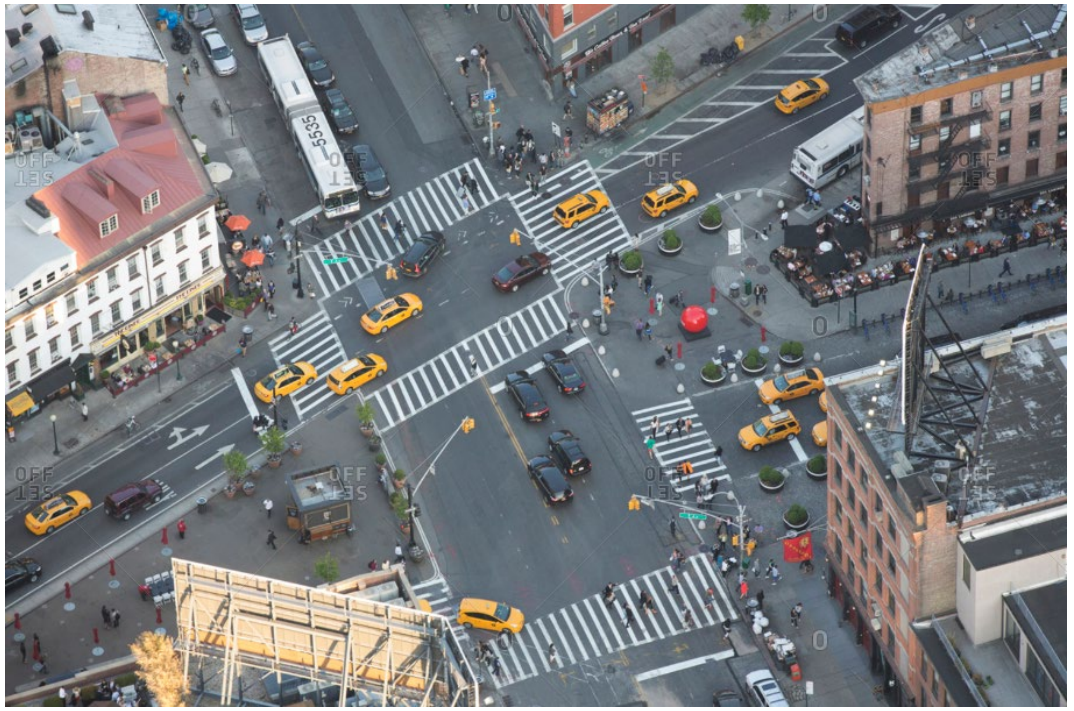
What about complex real-life urban settings?





What about complex real-life urban settings?

- Several pedestrians interacting with several vehicles
- Pedestrians needing to cross several lanes
- Vehicles going straight, and others turning right and left
- False sense of safety



Several dynamically-changing signals to decipher => The complexity increases the cognitive burden and the road danger

Increased difficulties for children, elderly people, people with physical, mental and sensory disabilities to move in the public space.

IFP message about communication signals:

The IFP is opposed to the introduction of **any kind of additional** signals (optical or audible) indicating automated vehicles' intended actions to pedestrians or prompt anticipated responses from pedestrians.

Is it fair?

The introduction of automated vehicles in traffic should improve road safety for all, not create further complications for some to handle.

Discussion around human factors

- Interaction with automated vehicles potentially more complex for the pedestrians.
- Interaction between drivers and road traffic sold as “easier” and “safer”.
- Powerful and misleading marketing, branding and story-telling about the current level of automation in vehicles (“Autopilot”, “Full” self-driving).
- Automated vehicles design: Large “inviting” touchscreens.

https://www.vibilagare.se/english/physical-buttons-outperform-touchscreens-new-cars-test-finds

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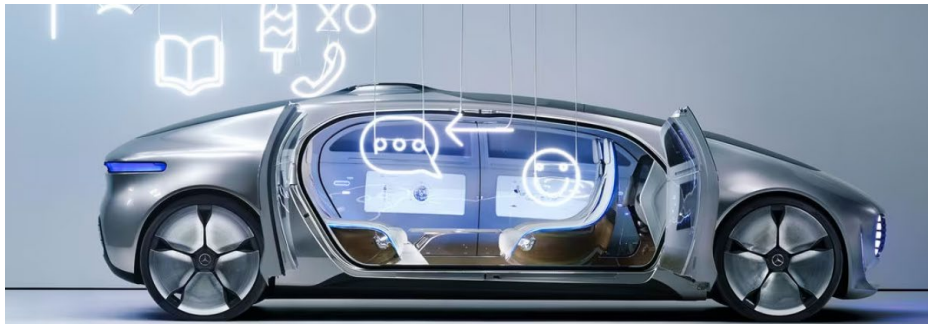
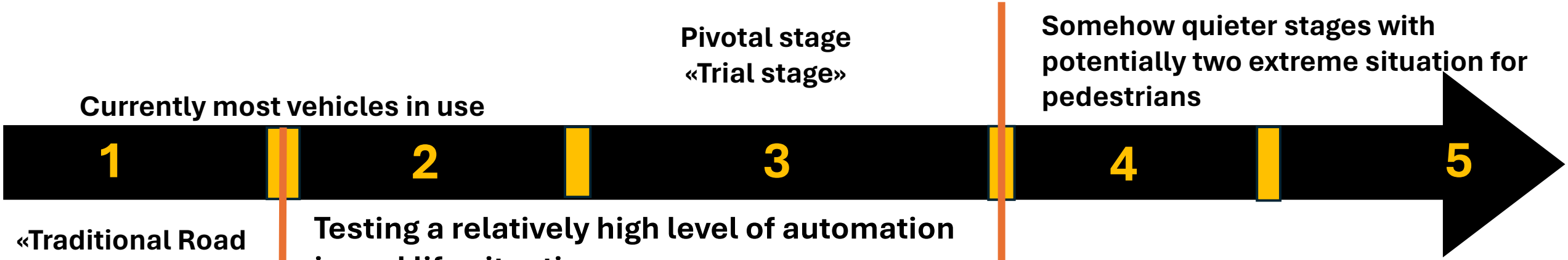
→Over-confidence in the system

→False sense of safety

→ New type of human errors may occur



https://www.mercedes-benz.com/en/innovation/autonomous/



«Traditional Road Traffic system»

- **Current safety issues**
- **Current measures**
- **Current responses**

Testing a relatively high level of automation in real life situations:

Increased risks for pedestrians and bicycles due to offsetting behaviours:

- New types of distraction
- Boredom of driving
- Losing the habit to drive and to take over
- Too big reliance on the machine: «laziness»
- “Inviting” dashboard (touchscreen, infotainment)

Once the use of automated vehicles has become commonplace, two "extreme" scenarios for pedestrians may emerge.

Many human factors likely to be underestimated

“Pessimistic” scenario

- Automation reduce the cost of driving: Increased miles driven
- Increased number of cars: pedestrians need to adapt and learn how to interact (less gaps between cars)
- Negative externalities remain: pollution (emissions, battery, tyre and road particles), noise, etc.
- More congestion: Increased urban spaces dedicated to automated cars
- Less active mobility : Sedentary lifestyles leading to negative health issues.

“Optimistic” scenario

- Streets are safer for vulnerable road users due to reduced human errors
- Optimisation of the use of automated vehicles leads to reduces number of vehicles: Options for mostly shared vehicles
- Shared mobility: Less negative externalities: emissions, battery, tyre and road particles, noise…
- Increased urban spaces dedicated to active mobility, public transports and social activities, Improvement of public health

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Thank you!

https://ifpedestrians.org