New technologies for vulnerable road users: some examples for pedestrians' safety and mobility

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Pedestrian crash statistics in France (ONISR, 2018)

=> Pedestrian deaths are about 14% of all road fatalities (in 2018, 470 pedestrians have been killed).

 opendir to other road accident victims, the part of pedestrians killed in mortality has increased: from 11% in 2000 to 14% in 2018.

% of pedestrians killed on road per age group (ONISR, 2018)

- People aged 75 years and over:
  - 9% of the French population
  - 40% of pedestrians killed on the road

- in cities (compared to rural areas)
- and in daylight conditions

=> Older pedestrians are overrepresented in pedestrian crash statistics in most European countries (OECD, 2011) as well as in the US (NHTSA, 2001), in Australia (Australian Transport Safety Bureau, 2002) or in Japan (Dunbar et al., 2004)

=> Pedestrians’ safety is actually an international issue.
To understand these crash statistics and to find ways to improve them, more and more research is being conducted on the issue of pedestrians’ safety.

The challenge of automation has also increased the research on pedestrians’ interactions with vehicles.
examples of research we have done about new technologies to improve pedestrians' safety and mobility
Older pedestrians training studies with virtual reality

The effectiveness of prevention and education?

The effectiveness of training programs?

⇒ Simulator training programs were able to improve and change behavior

購買 widely among the population


Technological devices allowing communication between pedestrians – vehicles – infrastructure

guiding street-crossing decisions?
We have designed and tested the effectiveness of a technological device allowing communication between pedestrians – vehicles – infrastructure.

Tests were run in a **virtual environment** to accurately emulate all of the necessary communication between the infrastructure, the vehicles and the pedestrians (e.g., localization with millimeter precision).

This is not yet available with current technologies, but could become possible in the near future with increasing research and development of connected objects and autonomous vehicles.
Participants were wearing a connected watch while answering a street-crossing task on the simulator.

The watch vibrates very strongly around the participant’s wrist to tell the participant that crossing is dangerous.
Most notable findings

« subjectively perceived as useful » by all participants

« objectively useful »: dangerous crossing decisions were reduced (0)

« limited trust »: 50% of correct answers (i.e. messages were challenged; participants deliberately chose to cross against the prevention messages, a too much guiding system, they felt like a robot)

Several advantages and limits according to :
- the age of the pedestrian (*maps ≠ devices providing information directly “on” the pedestrian*)
- the complexity of the information to deliver (*ex. roundabouts*)
- users’ experience (*discretion of the device, attention sharing, trust, etc.*)

Interactions of pedestrians with automated vehicles

Studying pedestrians’ interactions with automated cars to know if street-crossing behaviors will change.

30 young participants and 30 older participants participated in a simulated street-crossing experiment and perform a real walk across an experimental two-way street. They could either cross in front of automated cars that were programmed to always stop and let the pedestrian cross, or between traditional cars that approached at a constant speed and did not brake to let the pedestrians cross.

This work is supported by grants from the French Minister of the Interior, and from the Road Safety Department more particularly.
When an automated car gave way to pedestrian in the first lane while traditional cars (not yielding) were approaching in the second lane, risky behaviors (collisions) were observed, in young and older participants. Participants answered the opportunity offered by the automated car in the near lane but without sufficiently considering the far lane.

When crossing in front of an automated car in each lane of the two-way street, safety (systematic stop) but distrust were observed by later initiations and longer crossing times, especially when automated cars approached at short distances.
Designing new technologies for vulnerable road users

Designers have to address some dilemmas, to create devices that are desirable (human), feasible (technical), and viable (business). But answering all of these constraints is sometimes difficult…

Some psychological criteria for designing new technologies:


⇒ for older people, but in terms of universal design, if a device is accessible, usable, convenient and a pleasure to use for them, everyone benefits.
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