

# 7 ANTICIPATE ON THE INTERACTIONS BETWEEN PEDESTRIANS AND SELF-DRIVING VEHICLES

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Recent technological breakthroughs will soon turn delegated driving, so-called autonomous, vehicles into full-fledged players in the French road traffic landscape and across other industrialised countries.

These sensor-packed vehicles will amongst other things be capable of detecting the presence of a pedestrian at some distance and their algorithms will compute the engine controls required for any appropriate action (braking, deceleration, pulling out, etc.). These technological and scientific advances should therefore make it possible to reduce the number of accidents involving pedestrians through safer interactions. Self-driving vehicles could indeed make up for human mistakes, whether drivers or pedestrians.

## Behaviours and reactions yet to identify

Beyond the heavy technical constraints (e.g. sensors detection capacities, predictability, robustness and flexibility of the algorithms, etc.), this objective may only be achieved if self-driving vehicles and pedestrians can live and interact together in all safety.

Unfortunately, we are still lacking knowledge, be it only experimental, on the way pedestrians could behave in front of a self-driving vehicle. The question is particularly acute in situations of street-crossing, a key moment of these interactions and with the highest risk. Indeed, as the pedestrians are positioned on the roadway, or intending to do so, they are potentially in an imminent situation of collision with an approaching vehicle. Some work has been conducted abroad (e.g. Rothenbücher et al., 2016), but not yet sufficient to draw solid conclusions as to specific pedestrian behaviours (imprudent, more prudent, etc.).

## Technologies to anticipate the pedestrian's intentions

Another challenge to tackle is the capacity of sensors and algorithms of the autonomous vehicle to detect a pedestrian's intention to cross the street. More precisely, the matter is to know the criteria and variables to be used in determining whether the pedestrian imminently intends to cross the street while at the same time taking into account the applicable highway code in France (art R415-11<sup>3</sup>) "Any driver shall give way, if needed by halting the vehicle, to a pedestrian proceeding to cross a roadway, as authorized, or clearly indicating his/her intention to do so, or moving about in a pedestrian zone or meeting area".

## Studies liable to be conducted in virtual environment

Thanks to the developments of simulators and populated environments such as Lepsis, virtual reality may help addressing, at least partly, the

challenges related to the integration of self-driving vehicles into road traffic. It would thus be possible to place a pedestrian subject in an environment populated by non-playing characters (NPCs) and self-driving vehicles.

In order to start answering some of these questions about the prediction of pedestrians intentions and behaviours vis-à-vis self-driving vehicles, a joint study by Ifsttar (**LEPSIS** and **LBMC**<sup>4</sup>) and Institut Vedecom is currently underway on a large-scale street-crossing simulator.

1. **COSYS**: Components and systems Department
2. **LEPSIS**: Laboratory for road Operations, Perception, Simulators and Simulations
3. Article R415-11 of the French highway code
4. The Biomechanics and Impact Mechanics Laboratory (**LBMC UMR\_T9406**) is a joint research unit between IFSTTAR (Institut Français des Sciences et Technologies des Transports de l'Aménagement et des Réseaux) and Université Claude Bernard Lyon 1 (first French university in medical sciences).

## Further readings

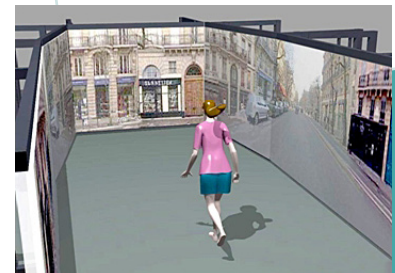
Rothenbücher D., Li J., Sirkin D., Mok B., & Ju W. (2016). *Ghost driver: A field study investigating the interaction between pedestrians and driverless vehicles*. In 2016 25<sup>th</sup> IEEE International Symposium on Robot and Human Interactive Communication (RO-MAN) (pp. 795–802).



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> The various simulators in operation at **LEPSIS**



▲ Street-crossing simulator developed by Ifsttar

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> Thematic paper on **Pedestrian safety**



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