How Vehicles Talk to Pedestrians

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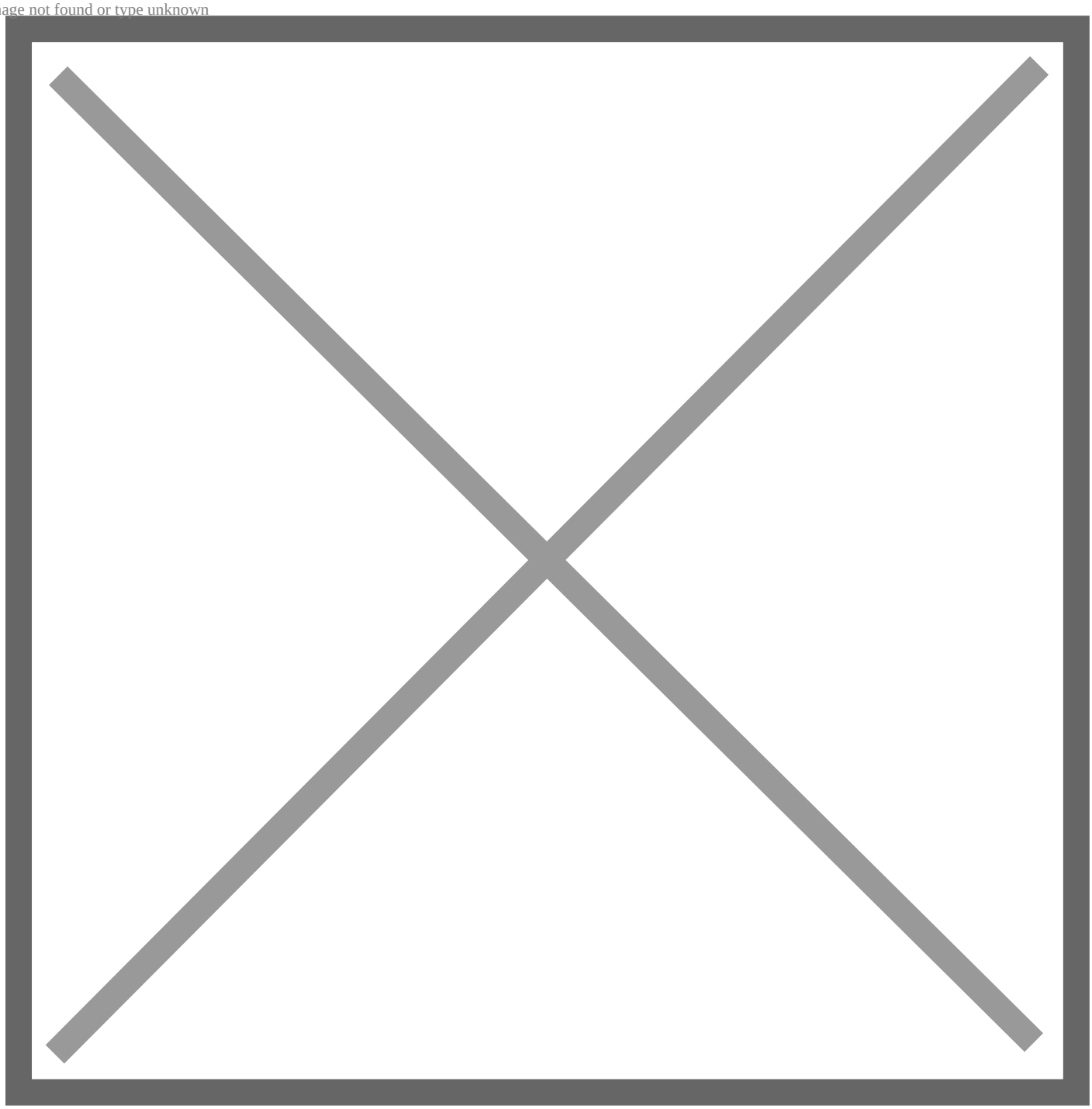

Whenever we cross the street or wait for the walk signal, we have ingrained behaviors and ways to signal our intent to drivers. Similarly, drivers behave in a way that signals their intents to pedestrians.

When developing automated vehicles, designers and engineers should consider and evaluate how drivers and pedestrians communicate based on each other's movements. These insights may ultimately be used to help design automated vehicles that are "polite" and "courteous" to the pedestrians with whom they interact.

What Toyota is studying: Working in collaboration with the Massachusetts Institute of Technology AgeLab and the University of Wisconsin-Madison Cognitive Systems Lab, Toyota's Collaborative Safety Research Center (CSRC) and researcher Joshua Domeyer have been studying how drivers and pedestrians signal their intent and interact with one another. The aim of the research is ultimately to inform the development of advanced vehicle safety and signaling features, as well as future automated vehicle technologies.

Why it's important: For automated vehicles to become widespread and for drivers to become comfortable with the idea of using them, the technology in the vehicles should learn how to behave and interact with pedestrians in a way that's common to drivers and pedestrians today. Designing complex and intricate systems to allow these vehicles to communicate politely and safely to other drivers and pedestrians will help them become more acceptable to the wider public.

What this could mean for society: The introduction of automated vehicles could have a huge impact on society. Crashes cause over 35,000 deaths each year and a large percentage of those crashes are attributable to human error[1]. Automated vehicles and advanced safety systems have the potential to greatly reduce crashes and save a substantial number of lives. Developing systems to allow humans and automated vehicles to seamlessly communicate will be key to ensuring their broad adoption.

How the studies work: CSRC has conducted studies that examine on-road communication to better understand pedestrian-driver interactions. One study created a large-scale simulation based on real driving data to identify important on-road social cues. Other studies have looked at the types of signals that are exchanged between vehicles and pedestrians at crosswalks.

https://toyota-cms-media.s3.amazonaws.com/toyota-videos/CSRC_JOSH_DOMYER_AGE_LAB_PED_CROSSING_BLURRED_NO_AUDIO.mp4

What the research has found: The studies have identified small behaviors that drivers perform in order to indicate their intent through movement. For instance, drivers typically begin stopping earlier and farther away for pedestrians than they would for a stop sign. This is a way of signaling to those around the car that the driver intends to stop for the pedestrian. Similarly, a driver will often slowly inch forward to indicate when they intend to proceed through the crosswalk.

Such behaviors are important for safe and polite interactions and can be applied to automated vehicles in the future.

How this might be applied to future Toyota vehicles: As automated vehicle technology advances, this research may be useful in standardizing the designs and methods for how vehicles communicate with each other and the world around them to create safe roads for both drivers and pedestrians.

[1]Singh, "Critical reasons for crashes investigated in the national motor vehicle crash causation survey," Nat. Highway Traffic Saf. Admin., Washington, DC, USA, Rep. DOT HS 812 115, 2015.