AUTONOMOUS VEHICLE INTERACTIONS WITH VULNERABLE ROAD USERS

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May 14th, 2019

CENTER FOR TRANSPORTATION STUDIES
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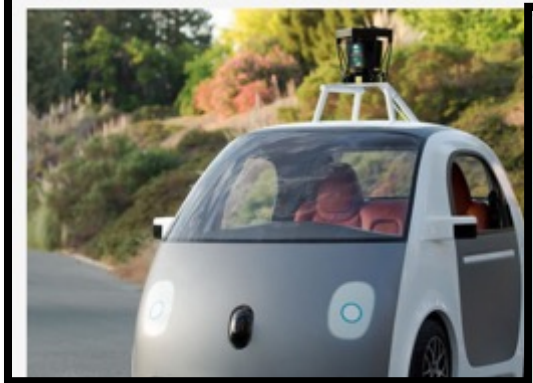
UVA ENGINEERING

HOW DO AUTONOMOUS VEHICLES DETECT BICYCLISTS?

"Bicycles are probably the most difficult detection problem that autonomous vehicle systems face," says UC Berkeley research engineer Steven Shladover.

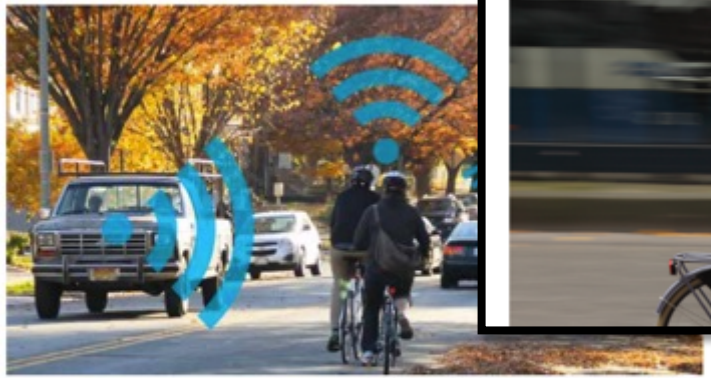
CARS

Wanna confuse a Google car? Do a track stand on your bike



Mob

RESEARCH NEWS

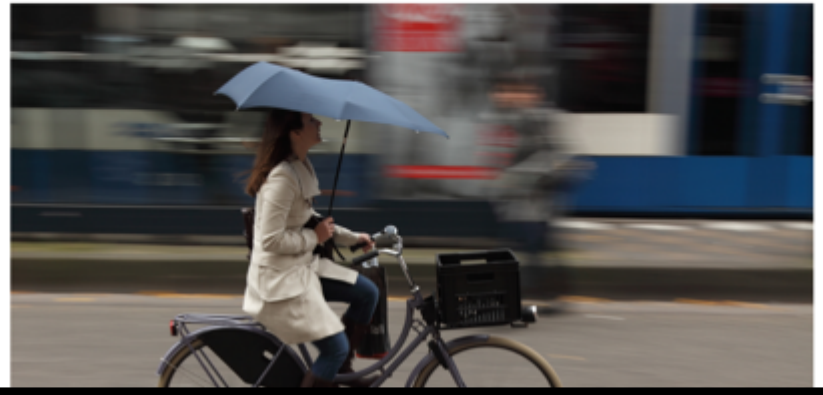


Why it's so difficult for autonomous vehicles to see bikes

By Kelley Coyner - August 31, 2017

Dutch 'most ready' to accept self-driving cars but bikes are a problem

Society February 12, 2019



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SAE J3016™ LEVELS OF DRIVING AUTOMATION

	SAE LEVEL 0	SAE LEVEL 1	SAE LEVEL 2	SAE LEVEL 3	SAE LEVEL 4	SAE LEVEL 5
What does the human in the driver's seat have to do?	You are driving whenever these driver support features are engaged – even if your feet are off the pedals and you are not steering			You are not driving when these automated driving features are engaged – even if you are seated in "the driver's seat"		
	You must constantly supervise these support features; you must steer, brake or accelerate as needed to maintain safety			When the feature requests, you must drive	These automated driving features will not require you to take over driving	
	These are driver support features			These are automated driving features		
What do these features do?	These features are limited to providing warnings and momentary assistance	These features provide steering OR brake/ acceleration support to the driver	These features provide steering AND brake/ acceleration support to the driver	These features can drive the vehicle under limited conditions and will not operate unless all required conditions are met		This feature can drive the vehicle under all conditions
Example Features	• automatic emergency braking • blind spot warning • lane departure warning	• lane centering OR • adaptive cruise control	• lane centering AND • adaptive cruise control at the same time	• traffic jam chauffeur	• local driverless taxi • pedals/ steering wheel may or may not be installed	• same as level 4, but feature can drive everywhere in all conditions

DRIVER ASSISTANCE SYSTEMS

Forward collision warning (FCW)

Automatic emergency braking (AEB)

Lane departure warning (LDW)

Lane keeping assistance (LKA)

Blind spot warning (BSW)

FCW & AEB could potentially prevent 1.99 million crashes 884,000 injuries, 4,738 deaths (85% rear end crashes and **74% of preventable fatalities were pedestrians and bicyclists)***

LDW & LKA systems could have potentially prevented 519,000 crashes (187,000 injuries, 4,654 deaths, mainly road departure crashes)*

BSW could have potentially prevented 318,000 crashes (89,000 injuries and 274 deaths, mainly sideswipe and rear-end)*

Overall: combined potential to prevent 40% of all passenger-vehicle crashes, 37% of injuries, and 29% of deaths*

*(Benson et al., 2018)

BEHAVIORAL ADAPTATIONS

?: Backup camera

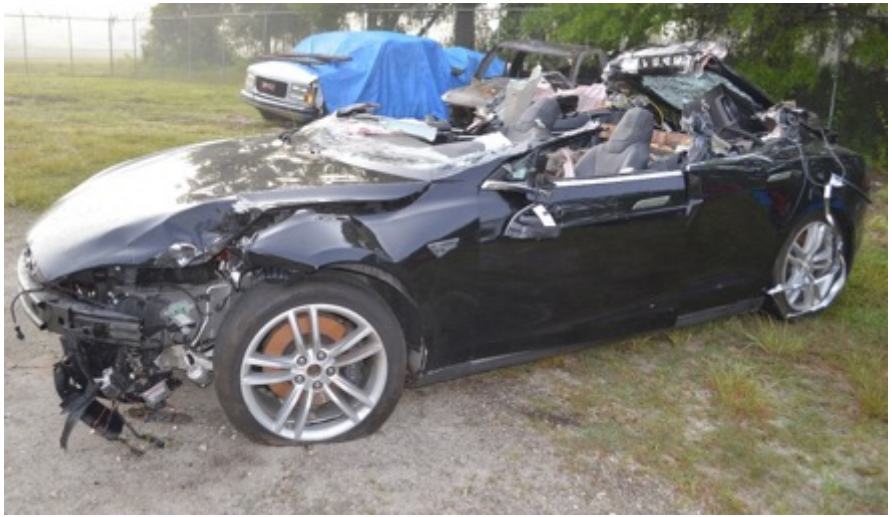
→1:4 owners with Rear Cross-Traffic alert (RCTA) sometimes backup without looking over shoulder

→1:3 owners with blind spot monitoring (BSM) sometimes change lanes without checking blind spot (McDonald et al., 2018)

OVERRELIANCE ON TECHNOLOGY

CRASH: Tempe, Arizona, testing of a self-driving Uber resulted in a pedestrian fatality. Safety driver was using phone and failed to brake.

CRASH: Williston, FL, Tesla in autopilot mode, driver over-reliance on automation (Poland, NTSB, 2019)



(Williston, FL, Photo by Florida Highway Patrol investigators)

HOW WILL PEDESTRIANS AND BICYCLISTS ADAPT TO AUTONOMOUS VEHICLES?

→ AVs will affect our road environment

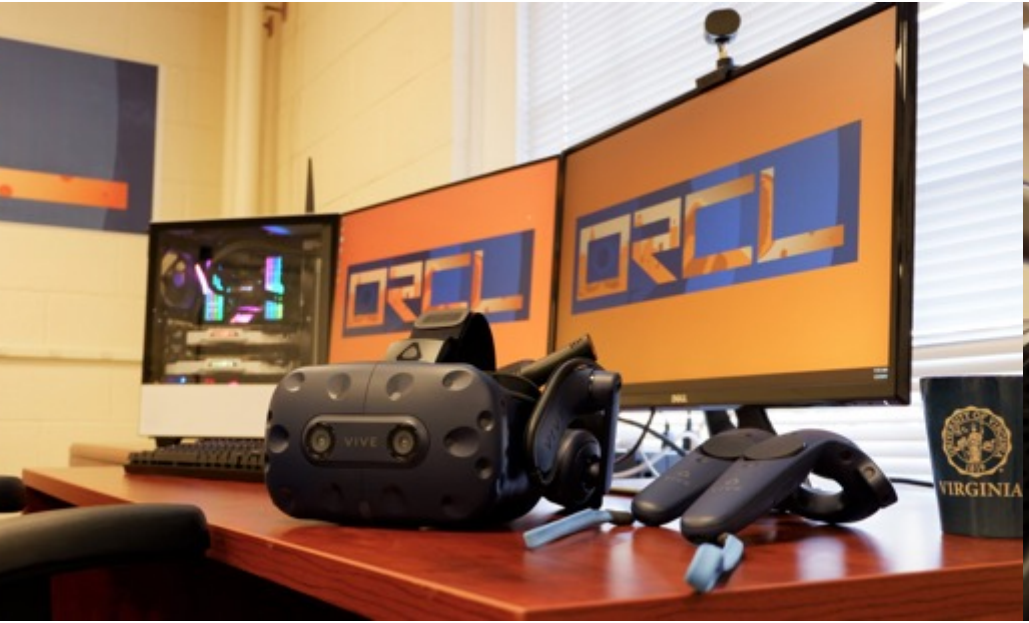
→ Drivers will adapt their behavior

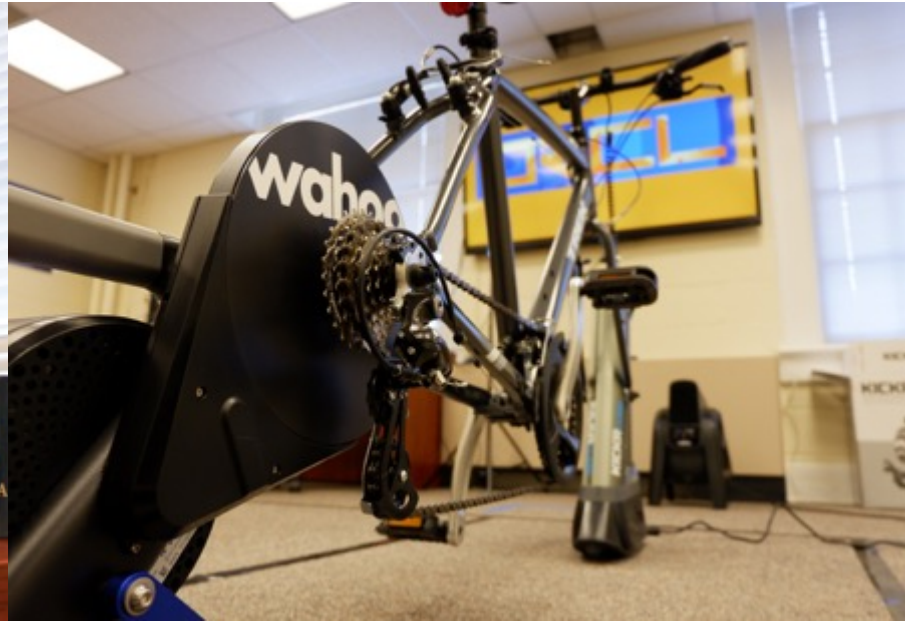
→ How will other road users will modify their behavior

Cautious

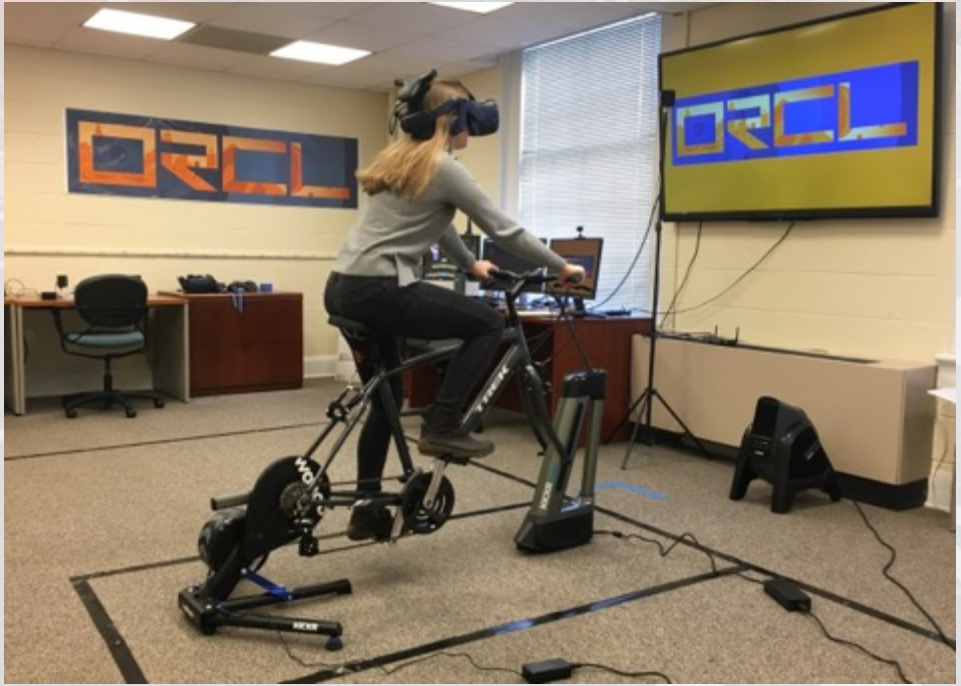
Fearless

HOW TO ADDRESS UNCERTAINTY OF FUTURE ENVIRONMENTS





BICYCLISTS AND PERCEIVED SAFETY



- Preliminary studies assessing what impacts bicycle use
- Concerns about safety → decreased bicycle use
- Perceived safety impacted by: motor vehicle speed, lane widths, motor vehicle volumes, presence of bicycle infrastructure, etc. Autonomous vehicles?

REFERENCES

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Questions?

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