Collaborative Sciences Center for ROAD SAFETY

Coffee and Conversation Speaker Series

Proceedings from "Closing the Gap: CAVs and the Mobility/Safety Paradox"
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Prior to introducing Dr. Tab Combs, Dr. Michael Clamann of the Highway Safety Research Center offers a prelude to her topic by referencing the oft-cited statistic that 94% of motor vehicle crashes are caused by human error [1]. He does so not to convince attendees of the need for connected/autonomous vehicles (CAVs) but to illustrate the driving rationale for many engineers and to open the door further discussion of what human error really means. He highlights that this statistic is complicated, but if we plan well, we don't have to wait to realize the benefits of improved automated technologies.

Dr. Combs then introduces herself and her field while noting that most of her work in the CAV discipline is focused on the impacts to vulnerable road users (VRUs). Her chief concern is mobility and access for VRUs, and she is concerned that few researchers are truly dealing with this issue.

Dr. Combs then notes that this discussion series has talked a lot about the safety benefits of CAVs, but that there needs to be more discussion of the negative impacts. Dr. Combs thinks that we need to scale our expectations of how beneficial this technology will be. She reminds us that the "now" is important because how we react to CAV technology and the greater transportation system now will shape how the system affects VRUs.

Dr. Combs then takes an aside to illustrate her point. She asks the crowd, "Who here has jaywalked?" Most hands in the crowd rise, with some attendees asking for clarification. Dr. Combs calls on some attendees to offer justification. Responses include:

- It's more efficient
- There's no crosswalk
- There's little traffic
- I was trying to keep up
- I have no desire to use a sky bridge
- I'm not simply darting out
- It actually grants me a feeling of safety because I'm not using an underpass at night

Dr. Combs then highlights that jaywalking, though having an aspect of legality, is also a social construct defined from the perspective of a driver who is inconvenienced. She asks a follow up question, “Who has thought pedestrians crossing the street are wrong?” Many attendees raise their hand. She uses this point to illustrate that the designers of CAVs may share that same perspective and not program in concern for pedestrians. This opens the question to whether or not CAVs should be pursued so aggressively when other accommodations can be designed into the system. “Most of us actually want to be safe and are jaywalking for legitimate purpose.”

Dr. Combs then shares a recent personal experience in which she jaywalked because there were two aggressive men on either end of the sidewalk making her feel unsafe. This was a calculated decision, and traffic stopped for her. However, would a CAV have stopped? “We cannot engineer our systems to ban behaviors (like jaywalking) – our system must be flexible.”

But how, exactly, do CAVs connect to jaywalking?

CAVs have huge benefits but serious shortcomings. Dr. Combs asks the crowd, “What kinds of facilities do we tend to see them depicted on?” The general depiction is a CAV driving on a highway. However, 87% of pedestrian facilities are not on highways, and 20% of pedestrian facilities are in rural areas [2]. This is problematic because CAVs are limited by their Operational Design Domain, i.e. geo-fenced urban areas. Therefore, the potential benefits may not be initially realized on highways (as often depicted) and outside urban areas, and there are still likely to be conflicts or limited operations where a substantial number of pedestrian fatalities occur.

Dr. Combs then transitions with, “Speaking of perfect CAVs…” and points out that there are still lots of things these vehicles can’t see. For example, Caltech has a 10-hour “benchmark” video against which detecting systems are compared to measure their performance. Current CAV computing software, when compared to this benchmark, is 1/10 accurate at recognizing pedestrians [3].

Dr. Combs then asks if anyone in attendance recognizes the significance of three dates. Few raise their hands. These dates correspond to three pedestrian fatalities in Chapel Hill. However, nearly every attendee recognizes the date of the Tempe fatality where the Uber vehicle killed a pedestrian. There are 400,000 search results in Google for this fatality. So, Dr. Combs asks, “Why would the Uber one be a headline rather than the three human drivers?” The reason is that we expect humans to be flawed, but not computers.

Dr. Combs then notes a third limitation of CAV technology. These vehicles can’t realize maximum benefits in uncontrolled environments. However, manufacturers don’t want special infrastructure and limitations. Jaywalking does not occur in a tightly controlled environment. There are two specific issues that may occur in these uncontrolled settings.

1. Pedestrians may attempt to game the system and force cars to stop. While this would be good for pedestrians, it would be bad for drivers and would perpetuate an adversarial road system. How would an Uber franchisee respond to this sort of disruption? One attendee in the crowd says that you'd probably advocate for legislation to punish pedestrians. Another attendee says that Google has already observed this gaming behavior occurring.
2. Platooning has a number of benefits for passenger vehicles. Dr. Combs demonstrates this with a video from a simulation. She also points out that there are no users other than cars in the simulation—and platooning behavior is likely to be undermined by the randomness imposed by pedestrians and other non-car travelers, which may again lead industry to push for legislation to prevent pedestrians from interacting with platoons…or accept that beneficial behaviors like platooning might have to be limited in order to maintain mobility for other modes.

At this point, Dr. Combs introduces the overarching question of her presentation. "Will we accept CAVs with these issues?" She suspects that the public will not, so researchers need to close these gaps.

Therefore, the transportation system will need to evolve. Dr. Combs raises some questions regarding how the system may evolve to accommodate CAVs and VRUs?

1. Will enforcement and separation be stronger?
2. Can we change road culture?
3. Will cars still rule roads?
4. Whose needs are being prioritized?
    a. One engineer claimed that only 2% of the population will benefit from CAVs in the launch.
    b. Can we help people whose needs aren't met now?
5. Which adaptation is more likely?

Dr. Combs concludes the discussion with a summary of key items. First, pedestrians cross the road because of calculated decisions, so our system needs to balance mobility and safety. Second, we need to figure out how to design a robust, holistic system. Stopping CAV progress likely isn't the key, but we also can't try to force people to walking.

The session ends with a question and answer section.

References

[1] S. Singh, "Critical reasons for crashes investigated in the National Motor Vehicle Crash Causation Survey. (Traffic Safety Facts Crash-Stats. Report No. DOT HS 812 115)," National Highway Traffic Safety Administration, Washington, DC, 2015.

[2] T. S. Combs, L. S. Sandt, M. P. Clamann and N. C. McDonald, "Automated Vehicles and Pedestrian Safety: Exploring the Promise and Limits of Pedestrian Detection," American Journal of Preventive Medicine, vol. 56, no. 1, pp. 1-7, 2019.

[3] S. Zhang, R. Benenson, M. Omran, J. Hosang and B. Schiele, "Towards Reaching Human Performance in Pedestrian Detection," IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 40, no. 4, pp. 973-986, 2018.