A First Investigation of Truck Drivers' On-the-Road Experience Using Cooperative ACC

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Introduction

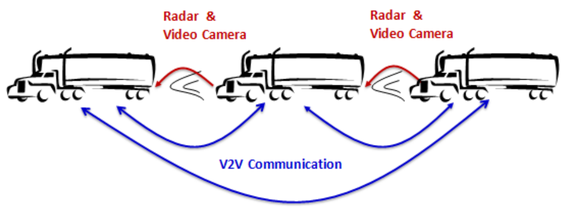
- Cooperative Adaptive Cruise Control (CACC) enables shorter vehicle following distances than traditional ACC due to enhanced string stability
- CACC can increase traffic density, relieve traffic congestion, and increase energy efficiency.
- The impacts of CACC on drivers' experience and performance are still largely unexplored.

On-the-Road Experiment

Participants

- 9 professional fleet truck drivers from the US and Canada

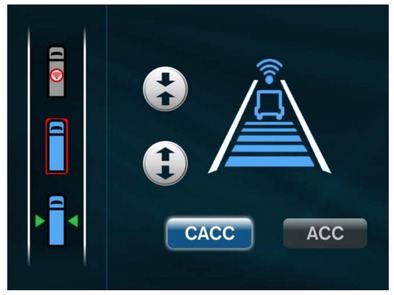
Trucks



On-the-Road Experiment

Driver-CACC Interaction

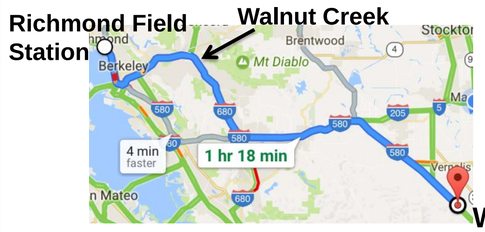
Driver-Vehicle Interface (DVI)



Time Gap (second) of CACC and ACC

Level	1	2	3	4	5
CACC	0.6	0.9	1.2	1.5	1.8
ACC	1.1	1.3	1.5	1.7	1.9

Route



Task Procedure for Drivers

- Training before Walnut Creek
- After Walnut Creek, drivers were free to choose preferred time gap
- Switched driver position at Westley
- Drove back via the same route

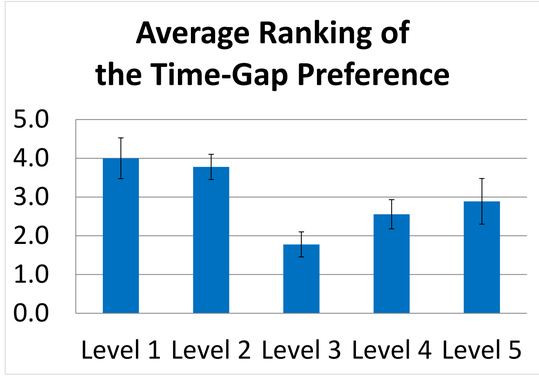
Results Discussion

Driver Demographics

Mean Age	48
Number and Gender	9 Male
Familiarity with ACC	1.4 / 7
Familiarity with collision warning systems	2.1 / 7
Familiarity with truck platoon	0.7 / 7

Time-Gap Preference

Drivers preferred levels 3 and 4 over levels 1,2 and 5.



Gap = 0.6 0.9 1.2 1.5 1.8

Truck Position in Platoon

- 5 drivers didn't notice the difference between 2nd and 3rd positions
- 2 noticed the difference in braking system performance
- Only 1 driver reported that truck position affected his road vision and he preferred the 3rd truck

Cut-ins and Road Grade

Debriefing Question	Results
Comfort with CACC response to cut-in	5.2 / 7
Trust in CACC response to cut-in	5.0 / 7
Reliability of CACC on upgrades	4.6 / 7
Reliability of CACC on downgrades	3.1 / 7

Concluding Remarks

- A first human factors study on cooperative adaptive cruise control for truck platooning
- Participants preferred time-gaps 1.2 s and 1.5 s the most
- The impact of truck position is very limited on driver vision
- Reliable CACC response to cut-in
- Less reliable CACC response to road negative grade

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