

An attempt to mitigate driver distraction with advisory information and auditory warnings

- Benefits of ADAS integration and different warning types effects on driving performance

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Agenda

- Distraction
- Situation awareness
- Purpose
- Experiment
- Results
- Conclusions

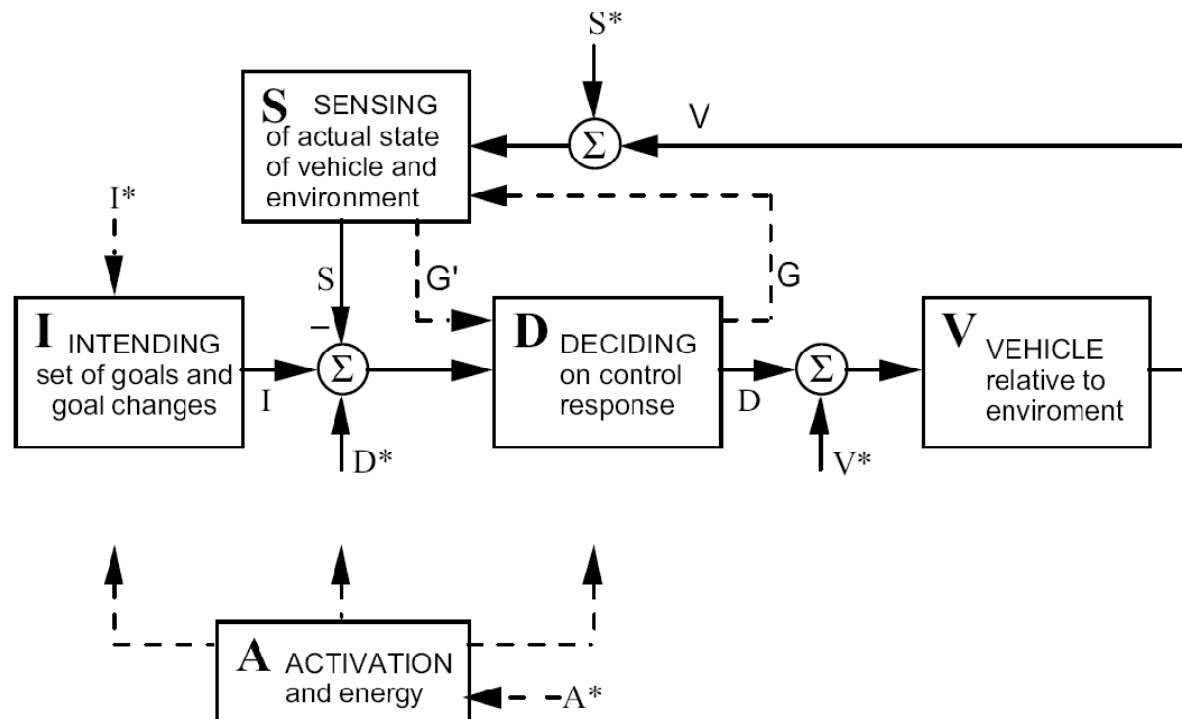
Distraction

- Driver distraction is the voluntary or involuntary diversion of attention from the primary driving tasks not related to impairment, where the diversion occurs because the driver is performing an additional task and temporarily focusing on an object, event, or person not related to the primary driving tasks. The diversion reduces a driver's situational awareness, decision making, and/or performance

(Australian Road Safety Board, 2006)

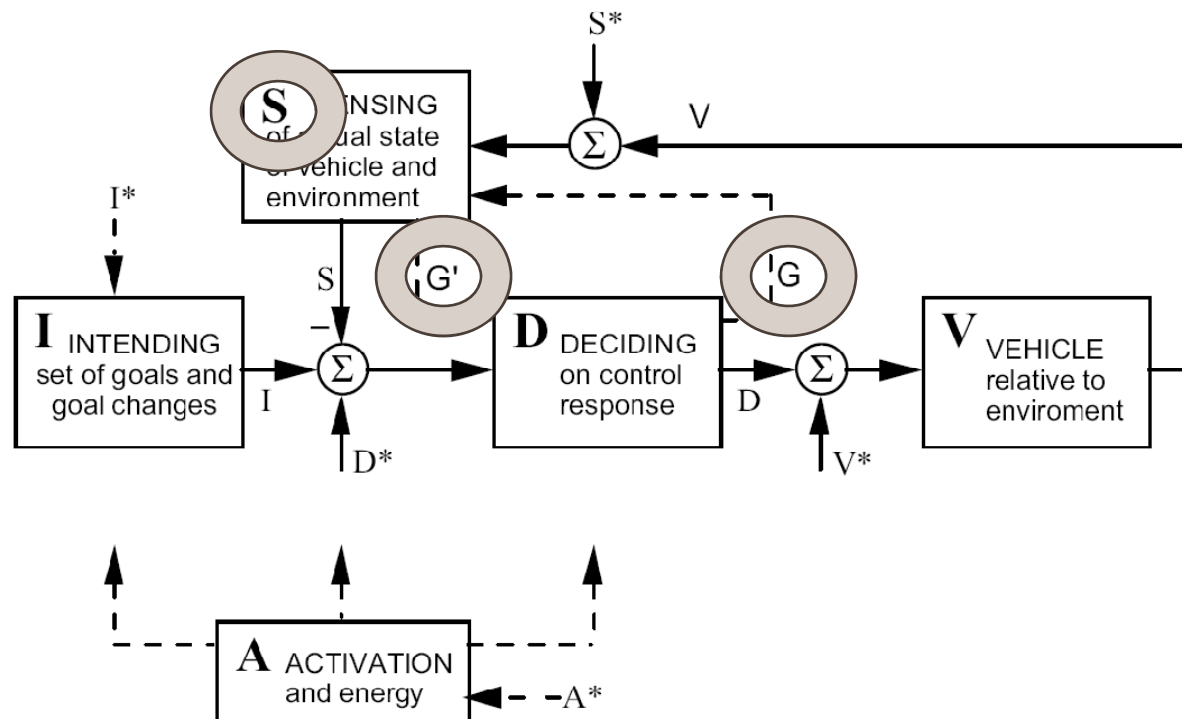
Distraction

- Distraction from a control theory perspective (Sheridan, 2004)



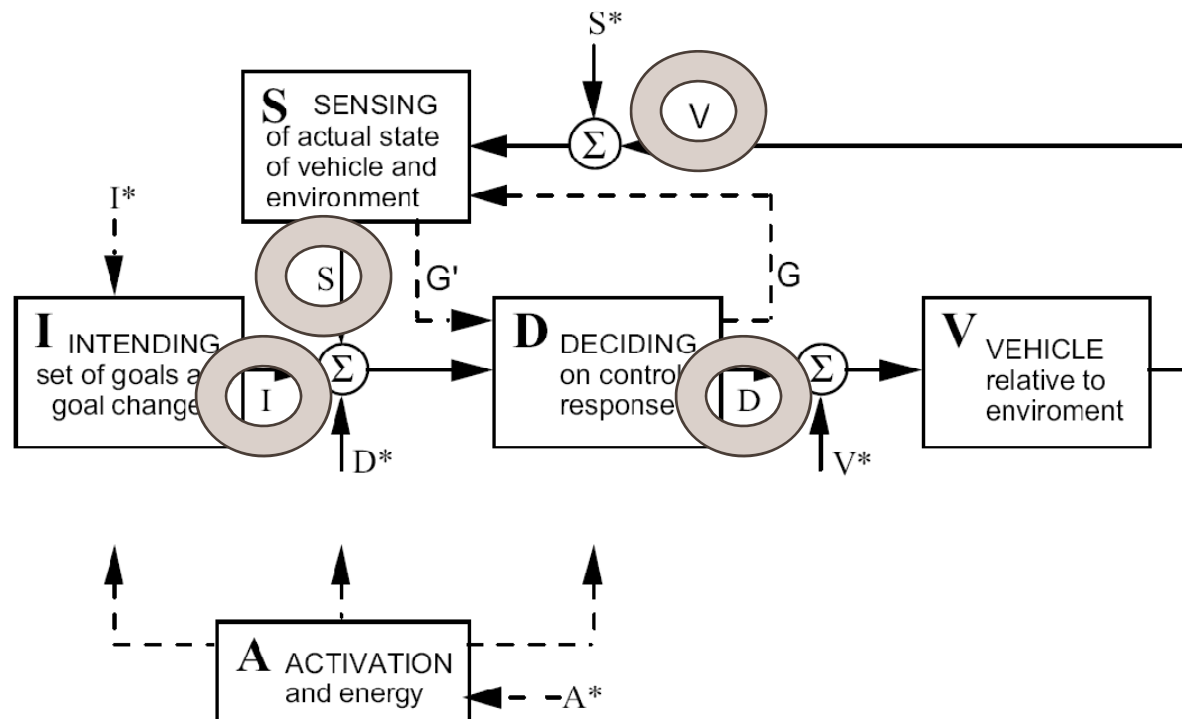
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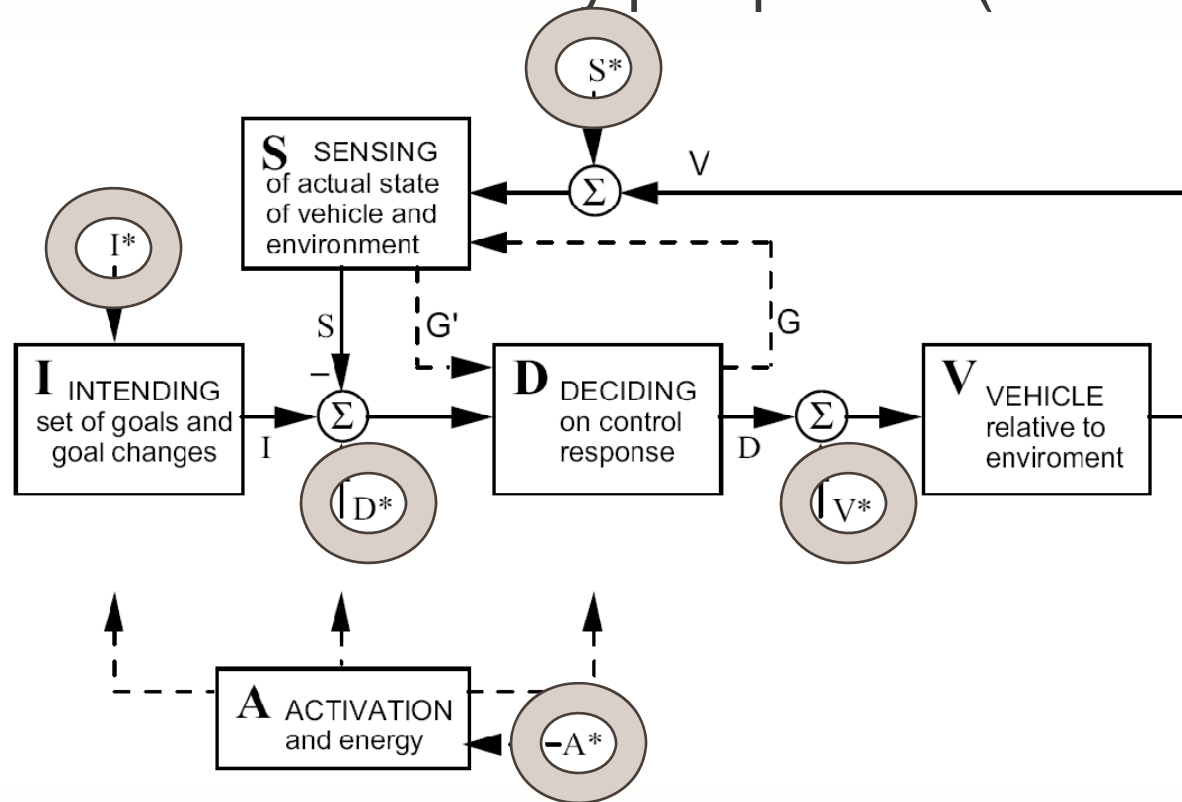
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Situation Awareness

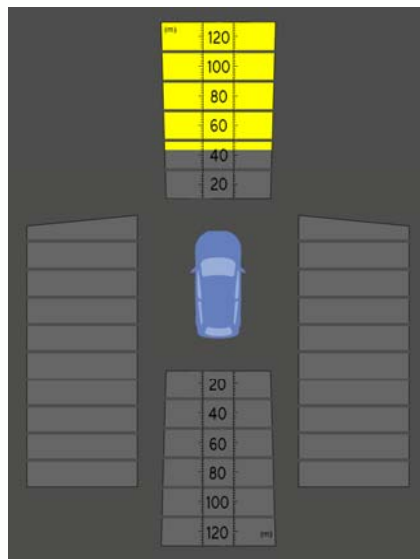
- “The perception of the elements in the environment within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future” (Endsley et al., 2003, pp 13).

Purpose

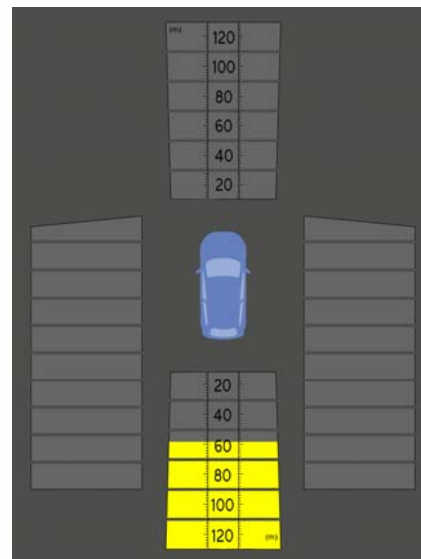
- Aim of advisory information is to support perception of objects in the environment during normal driving
- Auditory warnings aim was to switch drivers attention to a critical situation
- How these different warning modalities affect driver performance
- Does advisory information reduce triggered warnings?

Advisory information display

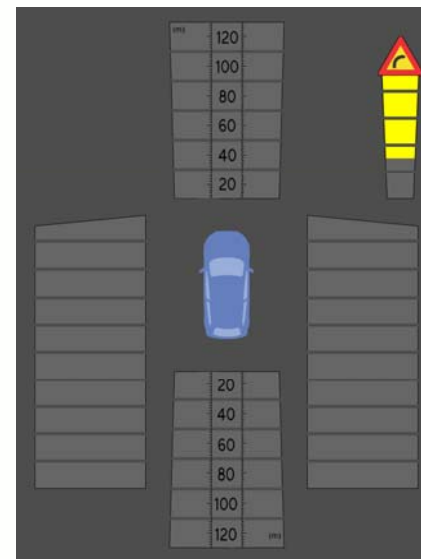
The Ecological interface design influenced interface
(Alvarado Mendoza et al. 2009)



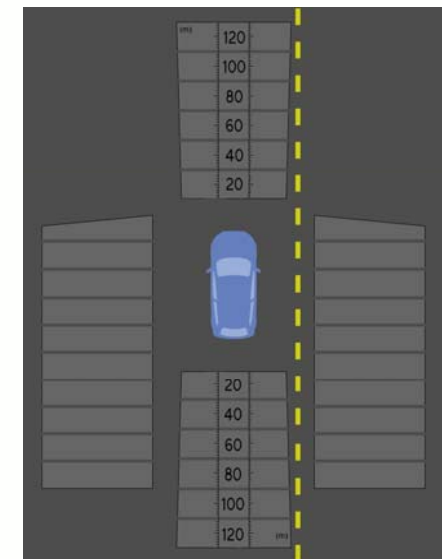
FCW



Rear after overtake



CSW



LDW

Simulator study - Method

16 participants – 8 women and 8 men – ages 27 to 43 years (M = 34,3, SD = 5) were recruited from the city of Dalian in China.

All participants had a valid driving license and were required to have normal vision (or corrected to normal vision using lenses) since wearing eyeglasses could degrade eye-tracking quality.

Simulator study - Method

- Medium Fidelity, Fixed based simulator STISIM Drive
- Three conditions – Baseline, Critical and Advisory
- Three kinds of incidents in each scenario – Lead vehicle breaking, Sharp curve & Wind gusts
- They were asked to drive 90 km/h and they were allowed to overtake slower vehicles if found necessary

Simulator study - Method

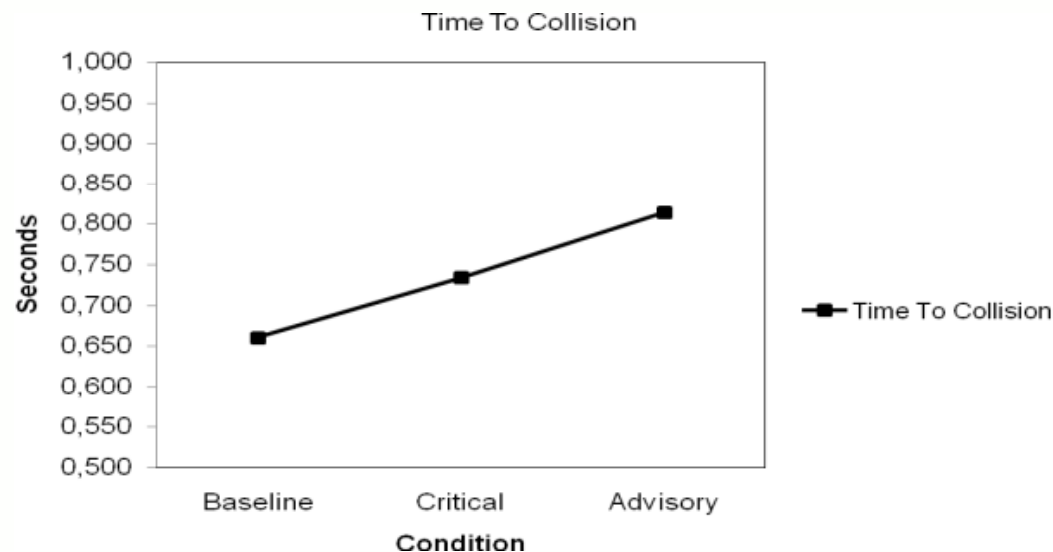
- Simulator Measures collected
 - Average speed
 - Percent road center (Eye-tracking)
 - Minimum time to collision
 - Standard deviation of lane position
 - Number of triggered warnings
 - Subjective questionnaire for Advisory and Critical condition

Simulator study - Results

- *Average speed* - Statistical analysis showed no significant difference in average speed.
- *Eye movements* - A mixed ANOVA failed to reveal any significant differences among the three conditions in terms of percentage road center (PRC) measured by the Eye-tracking system.

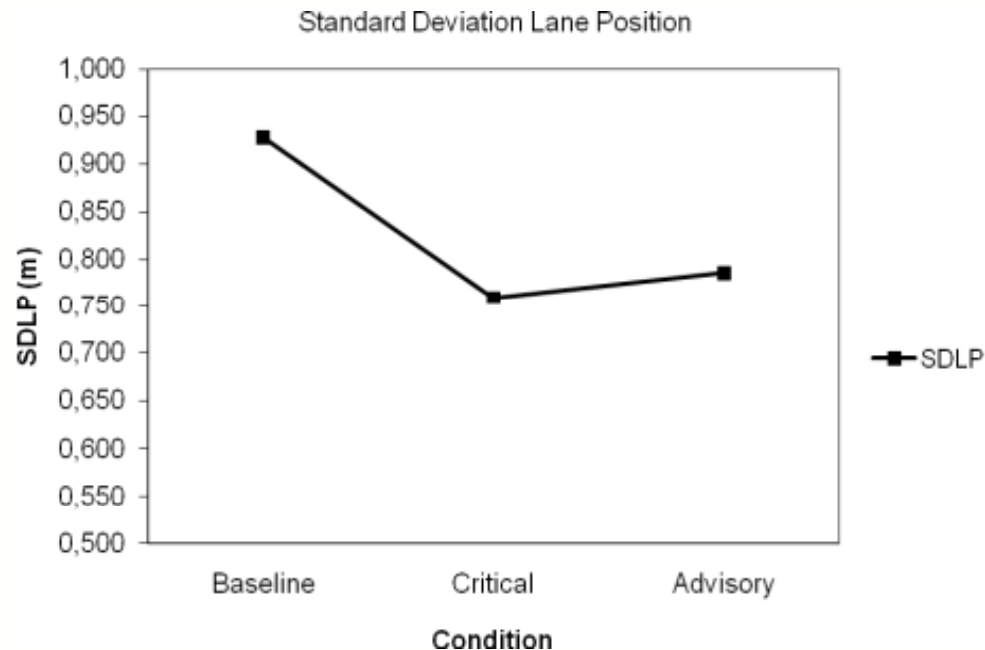
Simulator study - Results

- *Minimum time to collision* – Participants drove with significantly larger MTTC in both warning conditions compared to baseline.
- Indicative difference between advisory and critical condition.



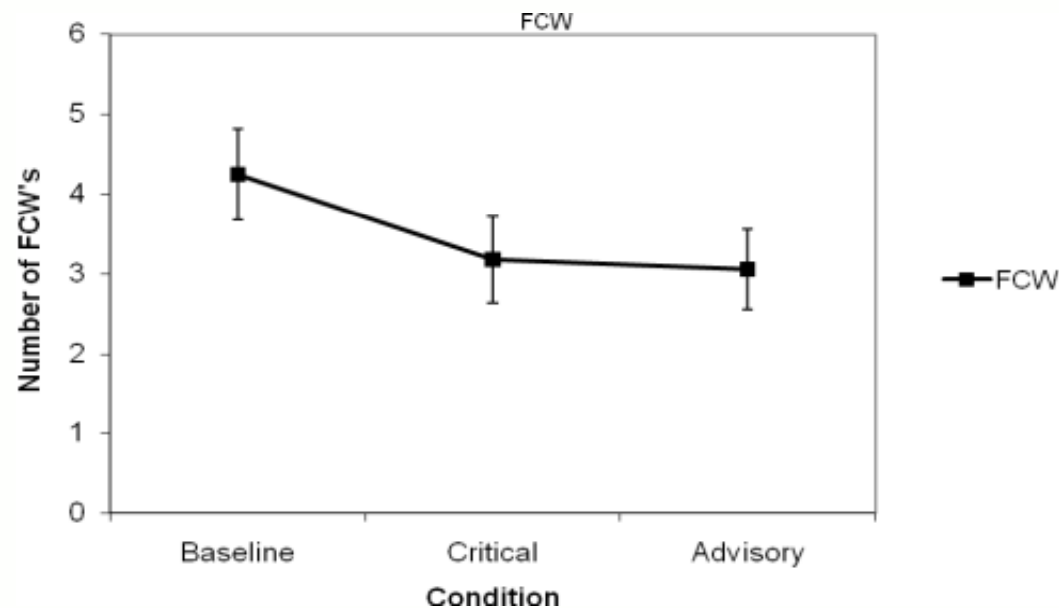
Simulator study - Results

- *Standard deviation of lane position* - Participants drove with significantly larger SDLP in the baseline condition than both warning conditions.



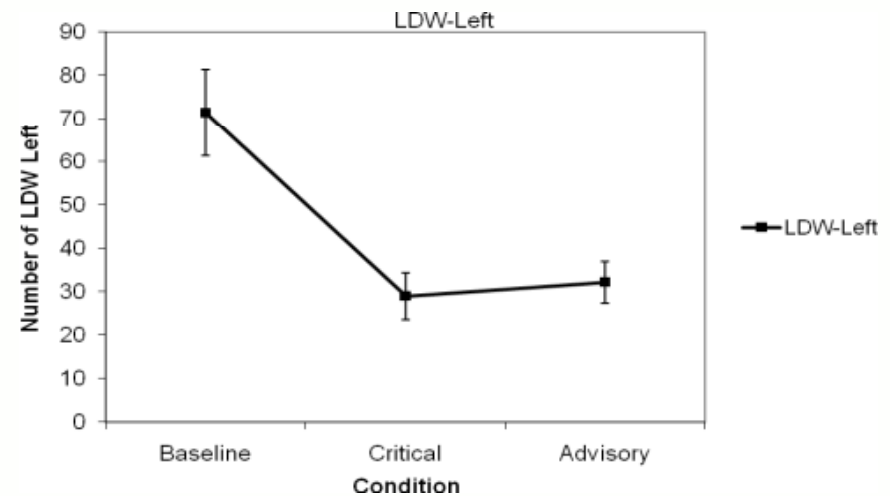
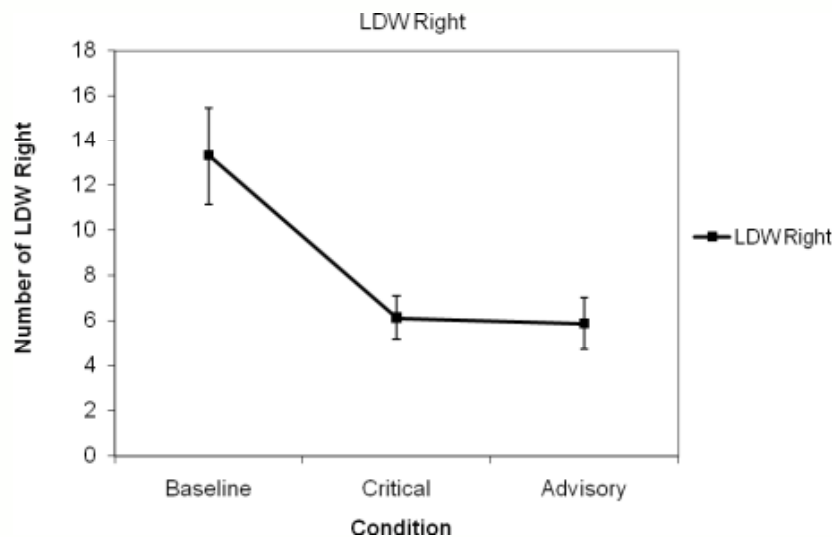
Simulator study - Results

- *Number of FCW's Triggered* - Participants triggered significantly more FCW's in the baseline condition compared to both warning conditions.



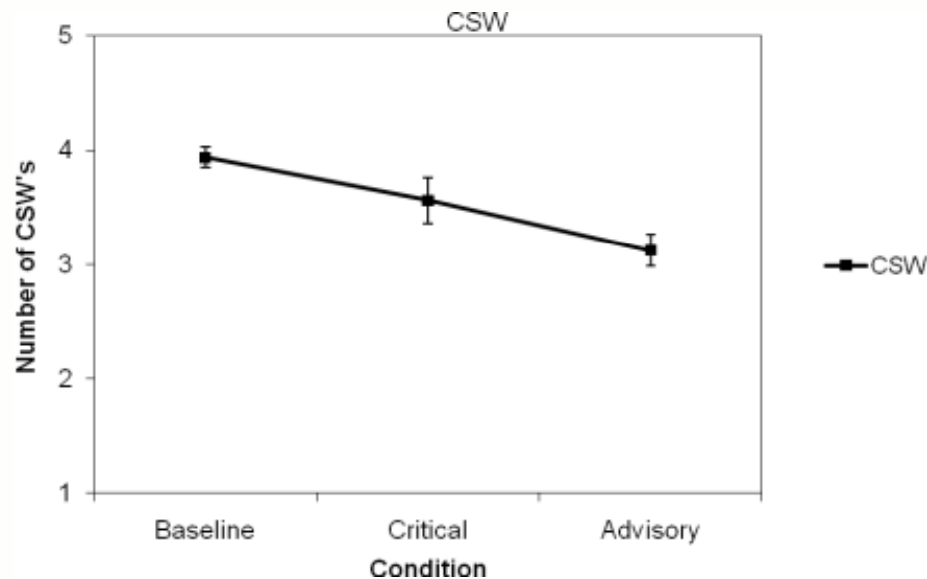
Simulator study - Results

- *Number of LDW-L and LDW-R triggered* - Participants triggered significantly more LDW-R and LDW-L's in the baseline condition than in both warning conditions.



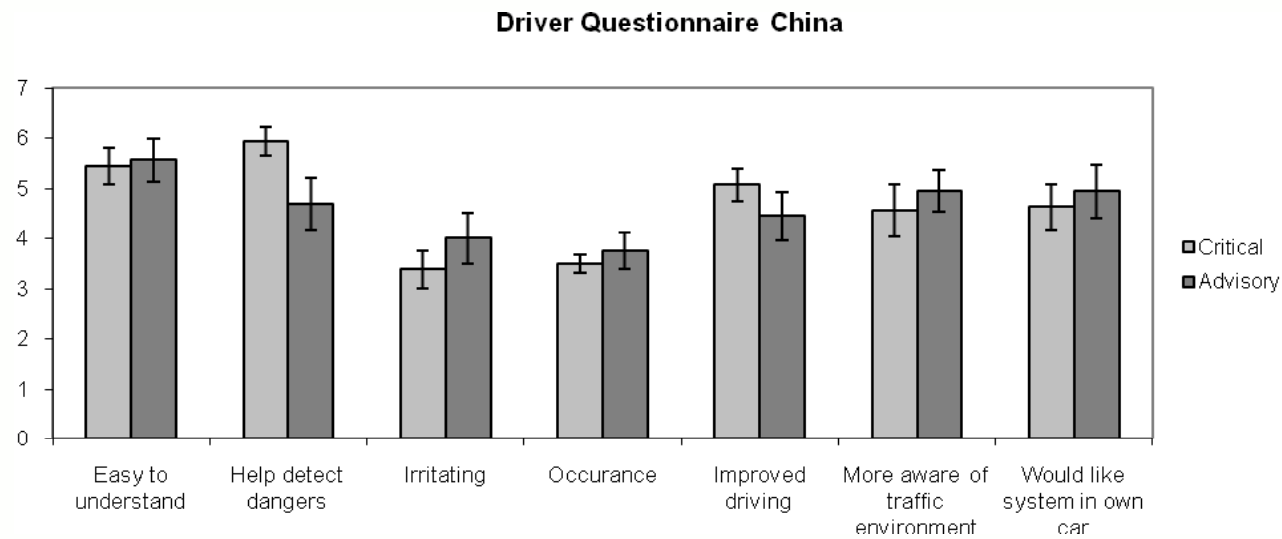
Simulator study - Results

- CSW's triggered - Participants triggered fewer CSW's in the advisory condition compared to the critical condition.
- The difference was indicative but not significant



Simulator study - Results

- *Subjective questionnaire* - There was no significant difference in the subjective results between the two warnings conditions. Participants found the visual display irritating and distracting in the interviews.



Conclusions

- Chinese driving is more complex – They therefore felt it would be distracting to look away less than a second from the road
- Auditory warnings were seen as a sort of advisory information
- Both warning modalities resulted in better margins to vehicles in front and less triggered warnings compared to baseline.

Conclusions

- Advisory information timings need to be researched further
- The advisory information in this study was focused on specific situations and may not be translated to real driving

Thank you!

Questions?