STRATEGICAL USE OF PERIPHERAL VISION IN DRIVING

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VISION VS EYE TRACKING IN REAL-LIFE TASKS

mid-peripheral



FOVEAL VISION

About 5 degrees of sharp detailed vision

Used for:

- Establish visual lead
- Targeting skills
- Reading signs and interpreting signals



CENTRAL VISION

About 20 degrees of useful information

Used for:

- Vehicle to roadway reference
- Viewing path of travel
- Viewing line of sight to target area

PERIPHERAL VISION

About 200 degrees of useful information

60°

110°

Used for:

- Motion changes
- Color changes
- Visual guidance
- Scene perception



HOW MUCH



AL VISION?

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WHAT DO WE SEE WITH PERIPHERAL VISION?

PROPERTIES OF PERIPHERAL VISION

Peripheral vison acquires information in parallel from across the visual field (gist)

Peripheral vision provide information to guide visual search

The most important limit on peripheral vision comes from crowding, i.e. vulnerability to clutter.

Although peripheral vision has poorer acuity and colour vision compared with foveal vision, these effects usually have a minor impact compared with crowding.







THE CURSE OF EYE TRACKING

Eye tracking is a mature and readily available technology

It teaches us about foveal vision targets, glance times and visual time sharing.

Since only foveal vision is measured, eye tracking provides a restricted view on visual information acquisition

HOW TO INVESTIGATE PERIPHERAL VISION

- Detecting deficits:
 - Visual field test
 - Useful field of view
- Continuous assessment of visual information acquisition
 - No direct method available
 - Indirect methods based on behaviour and responses







STUDY SUMMARY

Goal: estimate peripheral vision usage by comparing situations that should require foveal vision (or not).

Setup:

- Fixed simulator
- 35 participants
- 10 minutes of active urban driving

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DESIGN AND HYPOTHESES

Zebra crossing with stationary and moving pedestrians -need to act, need to foveate



Zebra crossing with stationary pedestrians – no need to react, little need to foveate



Zebra crossing without pedestrians - no need to react, no need to foveate



ANALYSES AND RESULTS

Did participants fixate the locations where pedetrians should be expected?

- Walking: All participants
- Standing: 7% did not fixate the pedestrians.
- None: 27% of the participants did not look at the location where pedestrians could be expected.

ANALYSES AND RESULTS

Did participants slow down (throttle release) or brake before the first fixation towards the pedestrian?



CONCLUDING THOUGHTS

- Foveal vision is used when pedestrians are present, presumably to identify whether they want to cross the street.
- Peripheral vision might be enough to confirm the absence of pedestrians.
- A third of the participants released the gas pedal before fixating the pedestrian, again suggesting information acquisition via peripheral vision
- In driver attention monitoring, not looking at a relevant area does not necessarily mean that the area was not considered

THANK YOU FOR LISTENING

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