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An eye-tracking study using animated video clips

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CYCLISTS' EYE MOVEMENTS AT UNCONTROLLED INTERSECTIONS

AN EYE-TRACKING STUDY USING ANIMATED VIDEO CLIPS

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INTRODUCTION

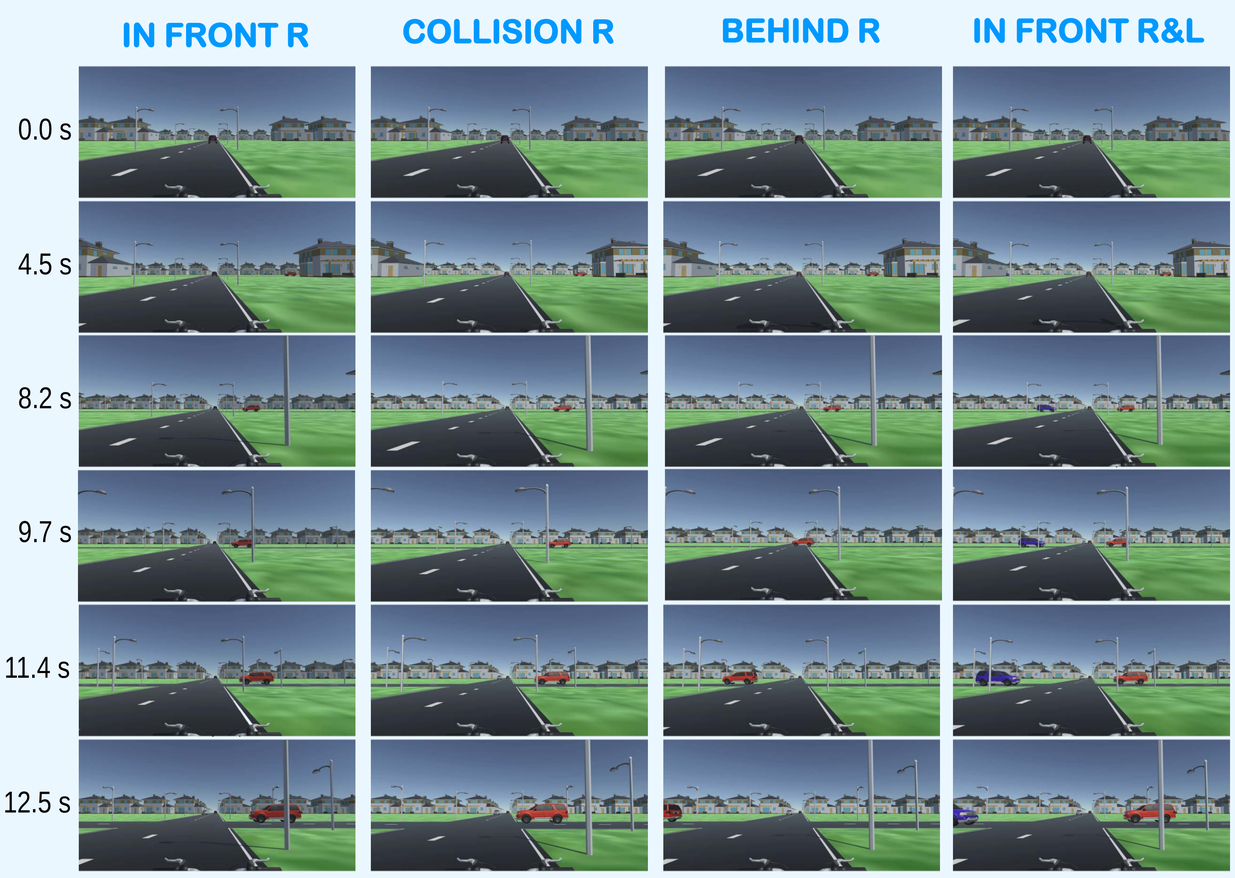
Research indicates that crashes between cyclists and car drivers occur even when the cyclist must have seen the approaching car, suggesting the importance of expectancy and attention allocation issues [1]. Once a relevant stimulus is detected in traffic, cyclist must make a judgement regarding whether the trajectory of their own bicycle and the vehicle of another road user has the potential to case a conflict [2]. To examine the sources of visual information that are involved in the anticipation of bicycle-car collisions at uncontrolled intersections, the cyclists' eye movements were recorded while they were watching various intersection scenarios i.e., cyclist passing the car(s) in front, behind, or colliding while cyclist approached at simulated at three different speeds.

METHOD

- Thirty-seven cyclists (*M* age = 21.0 years, *SD* age = 1.4 years) viewed animated video clips.
- Each experimental video clip was repeated three times.

- Independent variables of the fixed animations were:
  - fixed cyclist approach speed: 15 km/h 25 km/h 35 km/h
    Video clip duration: 22.7 s 13.6 s 9.7 s
  - approaching cars' deceleration:

Scenario	Initial speed (km/h)	Deceleration (m/s^2)	Final speed (km/h)
In front R	40	1.37	0
Collision R	40	2.89	10
Behind R	40	2.31	20
In front R&L	40&40	1.37&2.47	0&0

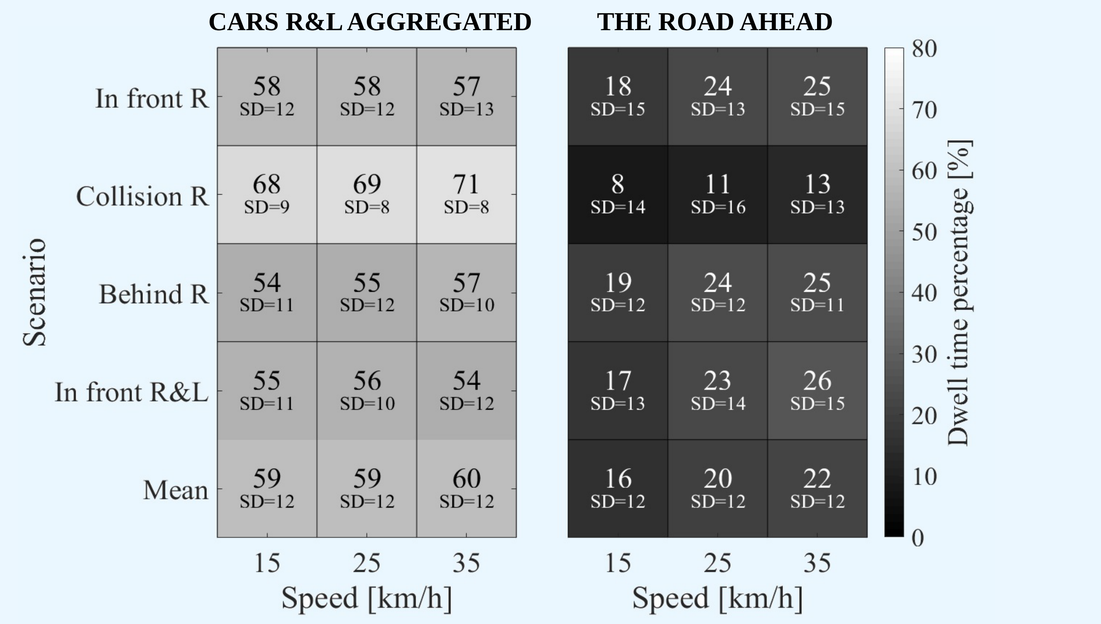


Sample frames from the animated video clips for cycling speed of 25 km/h from the beginning of the video till the moment when Car R almost disappeared in scenario *Behind R*.

- Eye movements were recorded using the Eyelink 1000 Plus eye tracker (SR Research) and analysed with dynamic areas of interests (AOIs) defined around the road ahead as well as cars approaching from right (Car R) and left (Car L).
- Visual behaviour was operationalized as the total dwell time percentage (DTP), defined as the composite percentage of all participants' gaze samples within each AOI taken across the sum time of AOI visibility per each condition.

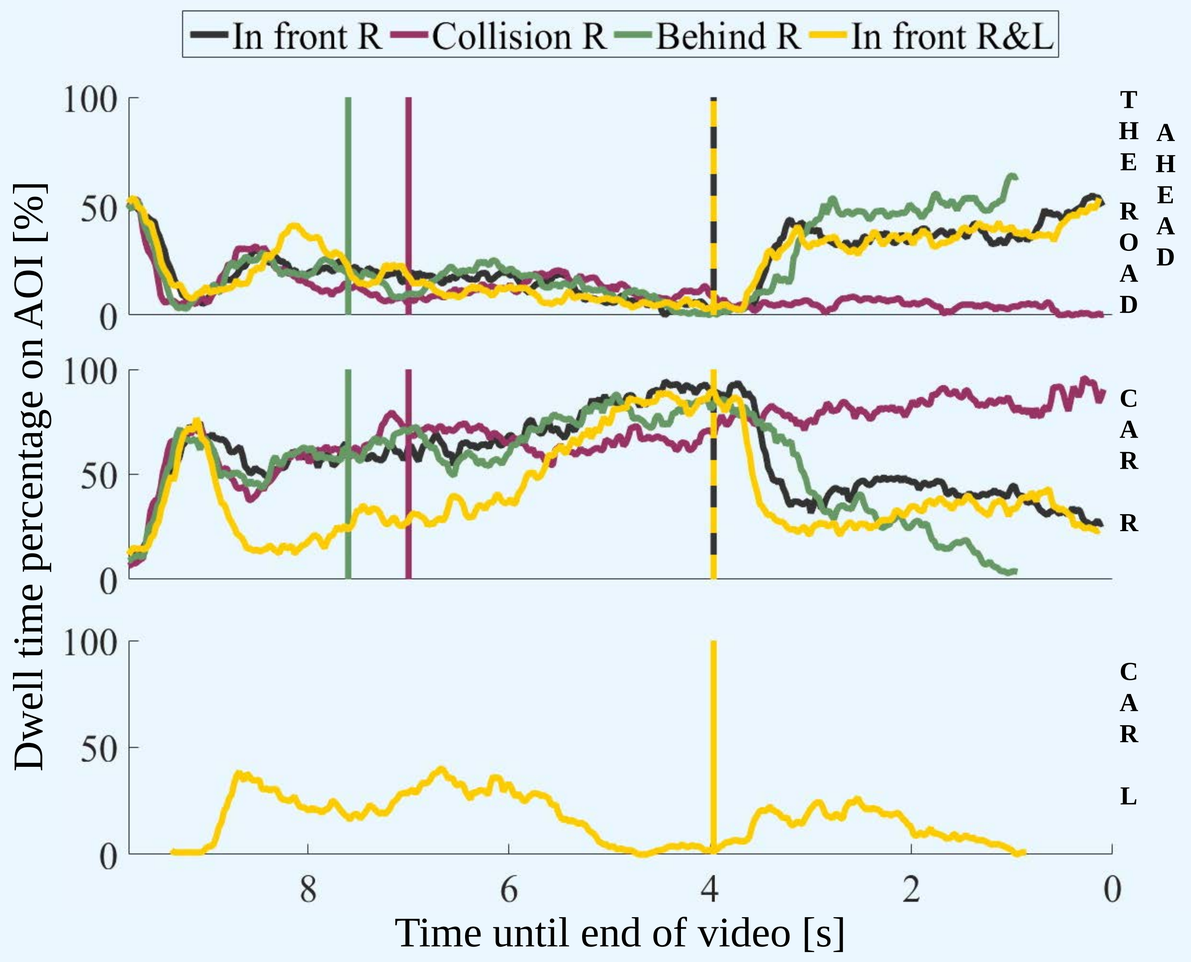
RESULTS

DWELL TIME PERCENTAGE ON AOIs (CARS AND ROAD AHEAD) FOR EVERY SCENARIO AND SPEED



- Visual behaviour of cyclists approaching uncontrolled intersections differ between situational aspects of collision/non-collision outcomes and location of cars at the intersection.
  - A high dwell time percentage on the right car was found in the collision scenario as compared to the three non-collision scenarios.
  - In the non-collision scenarios participants were more likely to direct their gaze on the road ahead.
- No substantial differences between the three cycling speeds regarding DTPs on the approaching car(s) .

DWELL TIME PERCENTAGE ON AOIs FOR A CYCLING SPEED OF 25 KM/H



The lines are plotted from the moment when Car R became visible for the participants till the video was occluded. The vertical lines indicate the moment in time at which Car R stopped decelerating.

CONCLUSION

- It might be generalizable that cyclists draw their visual focus along lines of perceived hazards and intent (i.e., objects with future collision trajectory potential and priority).

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