

The influence of light-induced dynamics on eye movements: A real-world driving study

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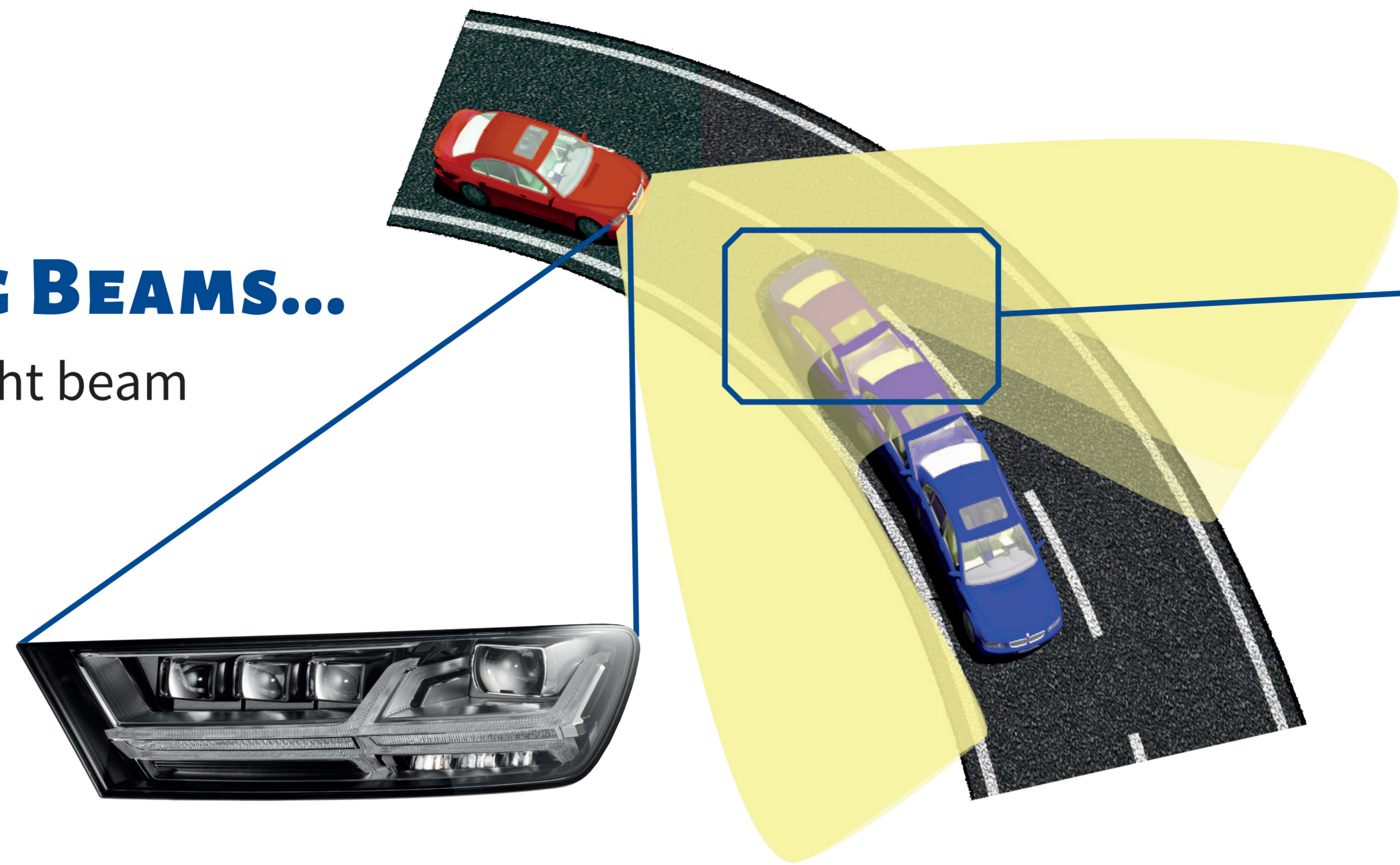
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ADAPTIVE DRIVING BEAMS...

...automatically adjust the light beam to avoid glaring others while still providing optimal illumination.



LIGHT-INDUCED DYNAMICS...

...are caused by adaptive driving beams, mainly during curves with a preceding car, and might capture attention due to their salience.



DESIGN

We used prototype adaptive driving beams with two settings producing either pronounced or subtle light-induced dynamics. Each participant drove with both settings while we measured their eye movements.

METHOD

16 participants (9 male) drove four road sections at night behind a preceding car. Two sections were driven with subtle and the other two with pronounced light-induced dynamics (sequence balanced). The participants should just drive as usually while ignoring the preceding car.

The car used in this study. It was equipped with prototype adaptive driving beams, which provided two settings. One produced pronounced light-induced dynamics and the other setting more subtle dynamics. The setting was changed unobtrusively inside the car after each road section. The participants did not notice the change and were not informed about the manipulation of light-induced dynamics.

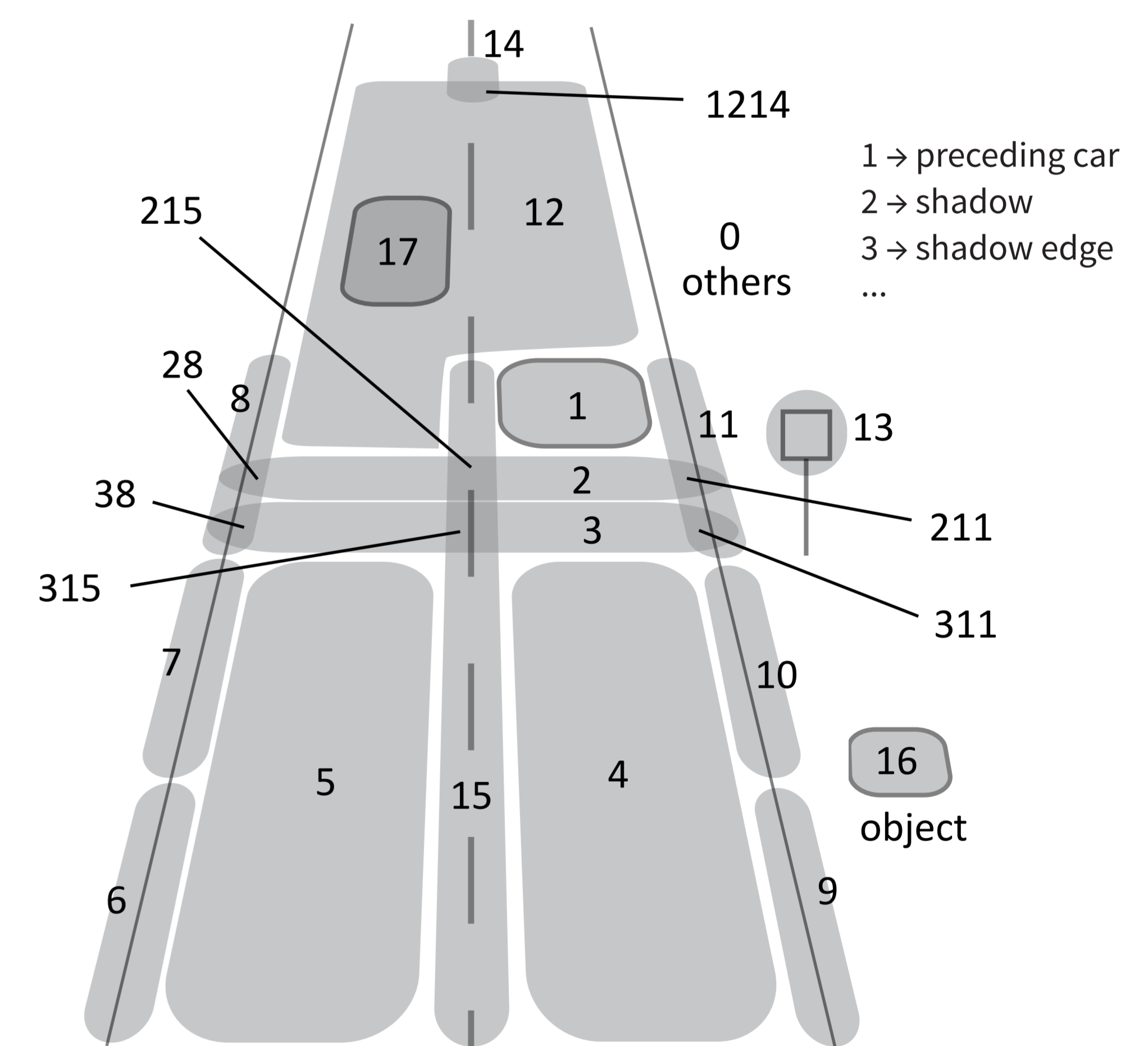
DATA ANALYSIS

We compared situations which differed in the amount of light-induced dynamics but were otherwise as similar as possible (left or right curves with similar lengths).

Since comparable scenes with different amounts of dynamics were scarce, we could analyze only 5 participants (3 males) by manually coding their gaze position at each frame of the eye tracker recording.

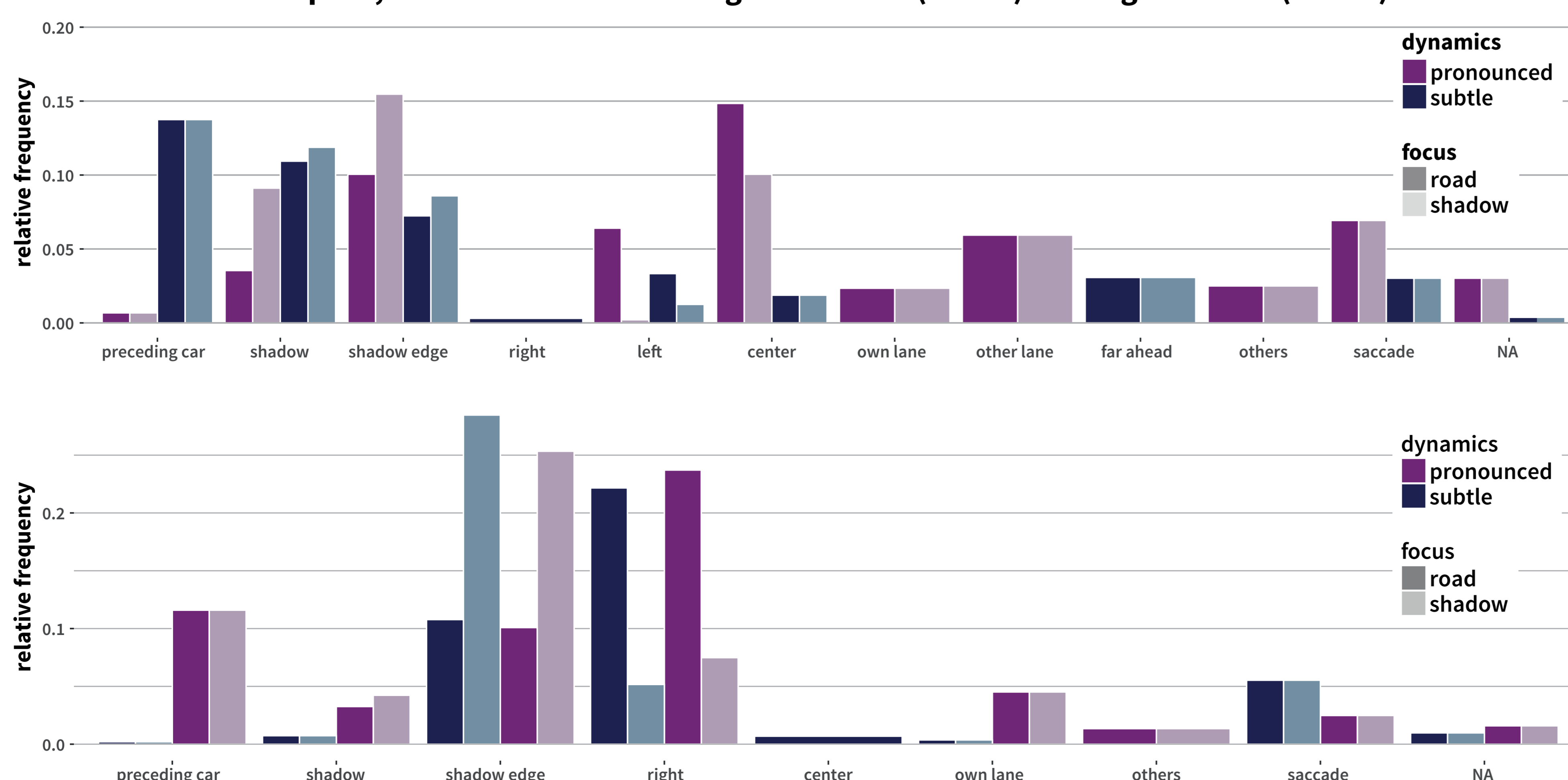


One frame from the eye tracker recording, coded as shadow edge.



The used coding scheme. We pooled some codes to single regions, for example, 11, 10, and 9 → right. Overlapping regions like 28 or 211 were analyzed twice; once as gaze at the shadow (focus shadow) and once at the underlying region (focus road).

1 Participant, Gaze Distribution During Left Curves (above) and Right Curves (below)



RESULTS AND CONCLUSION

Participants looked at light-induced dynamics even when these regions did not carry relevant information for driving. The difference between pronounced and subtle dynamics was not consistent, but the participants looked much less at the preceding car in situations with pronounced dynamics compared to subtle dynamics.

Light-induced dynamics attracted the gaze. Further research is necessary to minimize possible adverse effects of adaptive driving beams on driving safety.