„Cyclists running the red light – Influence of bicycle type under different conditions”

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What do we know so far?

- Red light running (RLR) is one of the most common traffic violations among cyclists

  → Surveys: 38% - 45% (Alrutz et al., 2009; Bacchieri et al., 2010)

  → Observational data: 7%-60% (Johnson et al. 2011; van der Meel, 2013; Fraboni et al., 2016)

- RLR has the potential to contribute to conflicts and crashes at intersections:

  Berlin, nearly 6% of all crashes caused by cyclists could be ascribed to red light violations (Stab des Polizeipräsidenten, 2016)

Influencing Factors for RLR

- Age or gender (e.g. Johnson et al. 2013; Wu et al., 2012; Johnson et al., 2011; Ceunynck et al., 2016)

- Type of the bicycle: Field observations in China showed that e-bike riders violated a red light more often than conventional cyclists (Wu et al., 2012; Yang et al., 2012, 2016; Zhang & Wu, 2013)

  → motor assistance might tempt to run red light

  → definition of e-bikes in China differs from Werstern

  → data from pedelec and S-pedelec riders is largely missing

What do we know so far?

Influencing factors

- Infrastructure type and use: available studies were conducted as stationary observations at selected intersections → they cover only one specific infrastructural scenario
- hardly any knowledge on the role of, e.g., the intersection type for red light running and the infrastructure which is used by the cyclists
- Only an American investigation concerned with infrastructure type:
  twice as many red light violations when the cyclists used bicycle infrastructure compared to when they used the carriageway (Cole et al., 2011)

→ The goal of the study was to characterise the red light running behaviour of cyclists in Germany, with specific focus on the potential effect of the bicycle type (bicycle, pedelec, S-pedelec) on red light run-ning frequency, as well as the infrastructural circumstances of the violations.

Naturalistic Cycling Study

= passive observation of cyclists „normal“ riding behaviour.

Data acquisition

- Video coding → red light running

Participants

88 participants

31 conventional cyclists	51.5 years old (SD = 17.2)
47 pedelec riders	54.4 years (SD = 16.7)
10 S-pedelec rider	41.7 years (SD = 17.5)

Gender

32

56

Observation of 4 weeks of cycling per participant

more than 4,300 trips

nearly 17,000 kilometres of cycling

Data preparation and analyses

Coding of red light situations

1. Identification of situations when cyclists encountered a traffic light
2. Coding of all encounters with a traffic light → red light situations were all situations coded in which
   - the traffic light shows red (90% of the coded situations)
   - situations in which the traffic light changes from yellow to red or shows yellow for more than 3 seconds
3. Detailed coding of red light running situations:
   - direction of cycling e.g. turning right
   - type of infrastructure used shortly before the traffic light was reached and when the cyclist was about to pass the traffic light e.g. bicycle infrastructure
   - intersection type e.g. T-intersection

- Identification of circumventions (infrastructure changes to avoid a red light)
- Calculation of a red light running rate for further analysis (excl. circumventions)
  = number of genuine red light violations / total number of red light encounters

Bicycle type and red light running

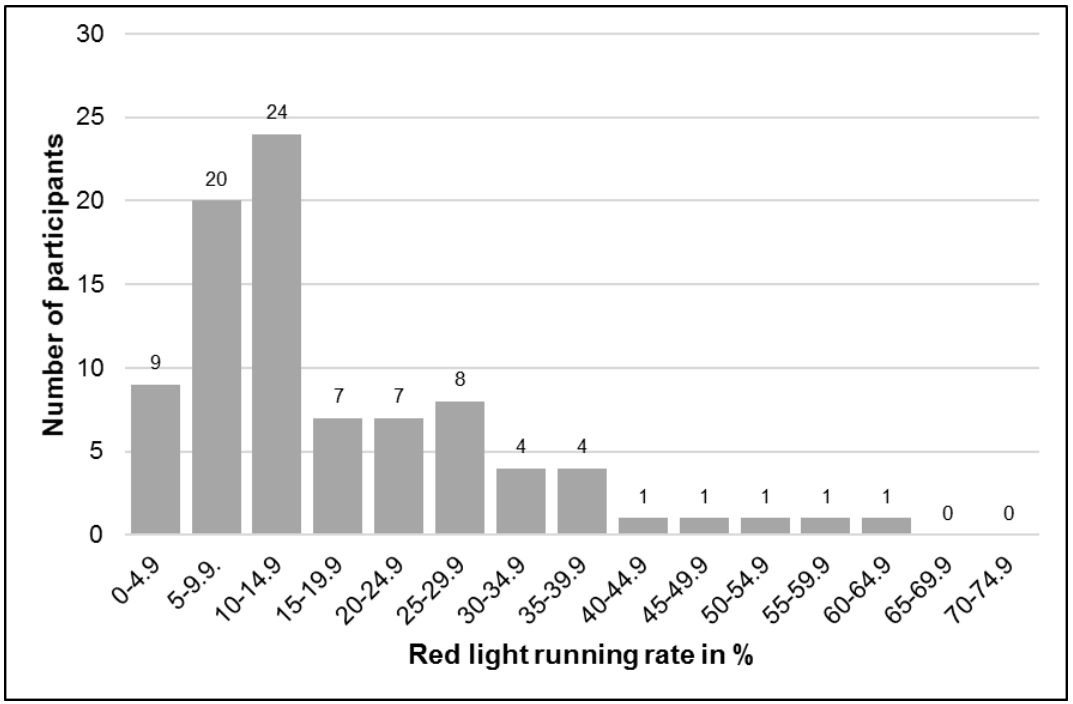
7,969 red light situations

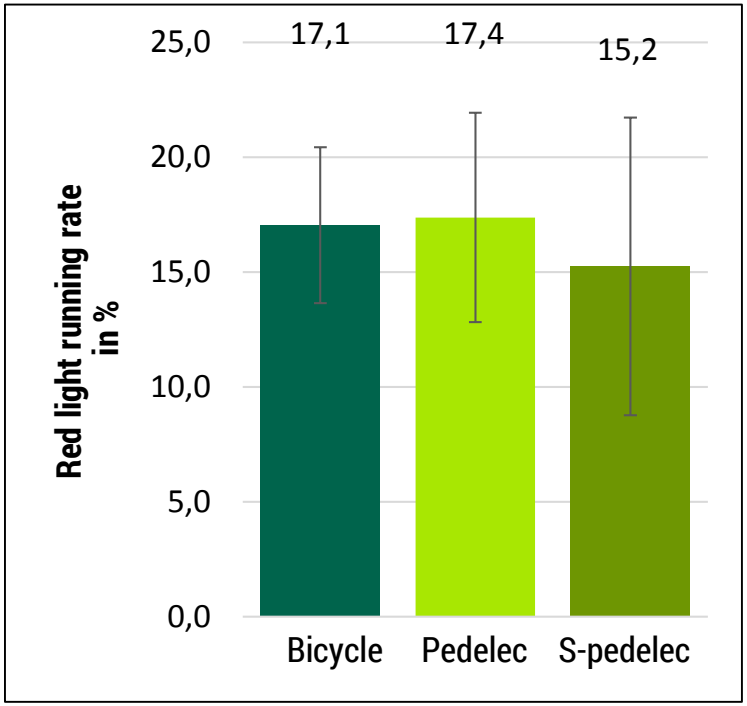
6,230 participants complied with the road rules

1,335 participants ran the red light

404 circumventions

} Red light running rate = 17%

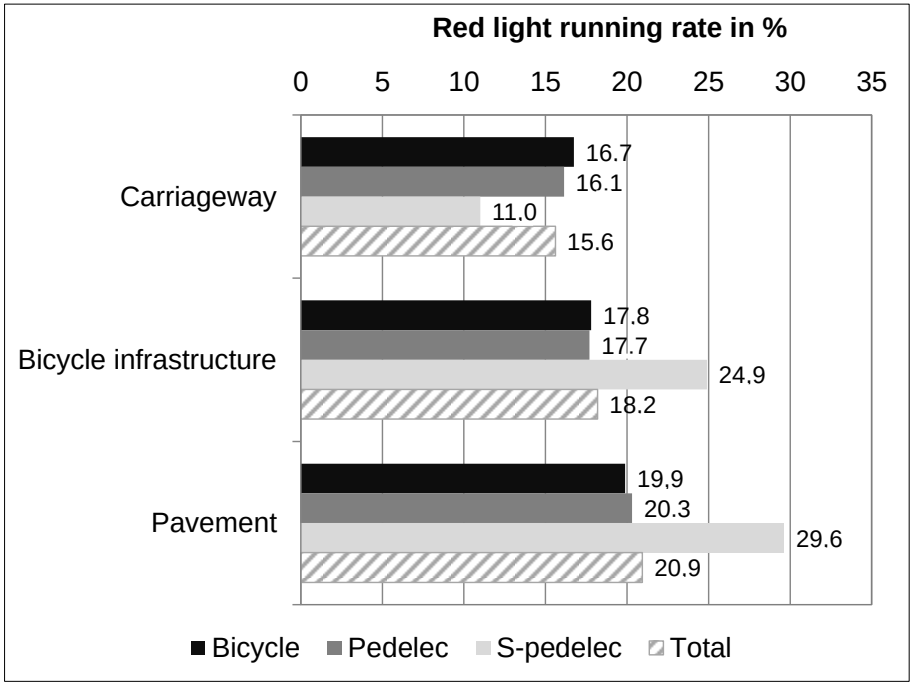




→ No significant differences between bicycle types ($H(2) = 0.77$, $p = .679$).

Circumstances of red light running

	Red light situations*	Bicycle type			
	N	Bicycle	Pedelec	S-Pedelec	Total
Passing straight	6,471	14.6	16.1	15.1	15.3
Turning right	449	66.8	51.2	40.3	56.3
Turning left	645	16.1	11.5	13.7	14.4



Circumstances of red light running

	Red light situations*	Bicycle type			
	N	Bicycle	Pedelec	S-Pedelec	Total
Five arms or more	7	16.7	0.0	0.0	14.3
Four arms	2,191	13.0	15.1	12.9	13.8
T-intersection (approaching on the road that ended)	337	50.0	36.4	23.8	37.7
T-intersection (approaching on the through road)	448	16.3	13.9	13.4	14.7
Railway crossing	38	24.1	40.0	0.0	23.7
Roads without junctions	209	36.9	19.3	4.3	26.3
Bicycle infrastructure crosses a carriageway or each other	3,128	16.6	16.5	24.7	17.0
Pavement crosses a carriageway or each other (pedestrian crossings)	1,207	20.3	19.9	20.4	20.1

Circumstances of red light running

	Bicycle type			
	Bicycle	Pedelec	S-Pedelec	Total
Number of circumventions	215	167	22	404
Total number of red light situations (incl. circumventions)	3,762	3,414	793	7,969
Circumvention rate %	5.7	4.9	2.8	5.1

In the majority of circumventions participants, independent of bicycle type, changed from the carriageway to the pavement (79.5 %)

In total, some form of violation, either by running the red light or by circumventing it, occurred in more than 20% of all red light encounters.

What do we know now?

Red light running

- Red light running rates of cyclists, pedelec and S-pedelec riders are moderate compared to observations from other countries (Cole et al., 2011; van der Meel, 2013; Fraboni et al., 2016)
- In addition to cases of genuine red light running, we were able to observe a substantial number of infrastructure changes to avoid stopping at the red light and continue the ride unimpeded.
- Total violation rate of about 20% (including circumventions) appears to be much lower than what has been observed, e.g., in Italy, but is nevertheless too high to be dismissed as isolated incidents

Bicycle type

- No significant difference in the red light running rates between pedelec riders, S-pedelec riders and conventional cyclists → clear difference to Chinese findings (Wu et al.; 2012)

What do we know now?

Infrastructure

- When turning right, red light running was more frequent (see Jahangiri, Elhenawy, Rakha and Dingus, 2016; Johnson et al., 2013)
- Red light running rates were highest at T-intersections, when approaching on the road that ended
- Violation rates were high for roads without junctions → good visibility, low traffic animated the participants to run a red light
- Small differences between bicycle types with regard to infrastructure use while red light running

Implications and recommendations

In practice,

- No differences between bicycle types but infrastructure has a possible influence on red light violations and might be regulated through design and construction measures

Recommendation:

- Interpretation of some results are difficult, a bigger sample size for specific factor combinations is needed
- Propensity to commit a violation in a certain scenario largely depends on context factors or others factors such as trip purpose or route choice.

  → These factors should be investigated further

Thank you!

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