# Study in real traffic: Investigation of the Impairment on Road Traffic through Animated Rear Lamps and Daytime Running Lights in Front Lamps

## 1. Management summary

A study to evaluate distraction by animation was executed. 41 test subjects were involved in the study. For this purpose, a traffic situation with several traffic participants and a parked (animatable) vehicle was generated. The parking position was conspicuously exposed to the viewing area of the test subjects.

The evaluation of the distraction or interference by animations in the front and rear gave a clear and clear picture.

Of the 41 test subjects, 91% stated that they felt "few" or "not at all" distraction or impairment from parked cars during their observation.
A total of 29% of the test persons noticed something conspicuous about the (clearly visible and conspicuously parked) test vehicle. 22% indicated the flashing of the central locking system while opening as an observation. Only 7% noticed the animations in addition to their traffic monitoring. Out Of these 7% (corresponds to 3 out of 41 people), 2 people (67%) did "not at all" and 1 person "few" (33%) felt disturbed by the parked vehicles. No one has been distracted or impaired "neutral", "little bit" or "strong".

This means that there is no connection between annoyance, distraction or impairment with animations (coming home / leaving home) by front or rear lighting. Animations were never found to be disturbing in the study carried out.

## 2. Background

With the introduction of LED technology, automotive lighting functions can be implemented with significantly more than one light source. In rear lights in particular, more than 70 LEDs can be used for one function.
Since 2017, a function test has been implemented while starting vehicle activities and to also visually show the driver the start or unlock process. This process is commonly referred to as the "Leaving Home Function". Together with the "Coming Home Function", both processes might be observed on a stationary vehicle.
Several vehicles with this function have been available within the Audi product family over the past few years, although the detailed animations differ depending on the headlights and rear lights.

Relevant vehicles: Audi: TTRS, A8, A4, A5, A6, A7, A3, e-tron, Q8, Q7.

## 3. Purpose of study

When locking or unlocking the car (in addition to the standard double TI flashing) the daytime running lights or rear light LED are activated for a period of 2..3 seconds. Since the light functions are thus visible to outsiders, the question of potential distraction, impairment or even nuisance arises. The present study takes the task of analyzing the impairment caused by animations in real traffic situations.

## 4. Experimental setup:

The assumption of impairment, annoyance or disturbance seems to be difficult to quantify with physically measurable parameters. In this case, a survey of road users was chosen to evaluate a traffic situation.

### 4.1    Choice of location:

When choosing the location, attention was paid to a test site and environment that contains different road users, activities and traffic regulations. Criteria for the traffic situation were:

- circulating traffic
- cars, trucks, buses
- pedestrians
- cyclists
- traffic lights
- pedestrian crossing
- parking traffic
- visible animation on a parked vehicle.

The market place of the municipality of Kösching in the Eichstätt district was chosen as a suitable location, meeting all relevant criteria.

### 4.2    Observation situation

The relevant parked vehicle was in the field of view of the observed test subjects (schematically in Fig. 1 and Fig. 2, photo representation of the situation in Fig. 3 and Fig. 4). Special care was taken to ensure that the test subjects had a clear view towards the animation.
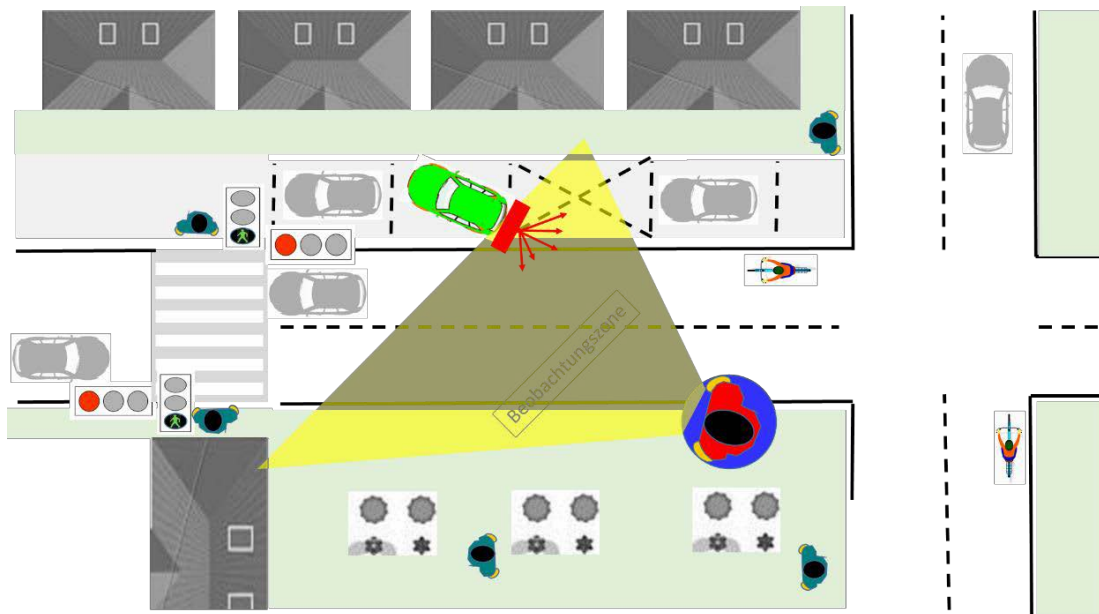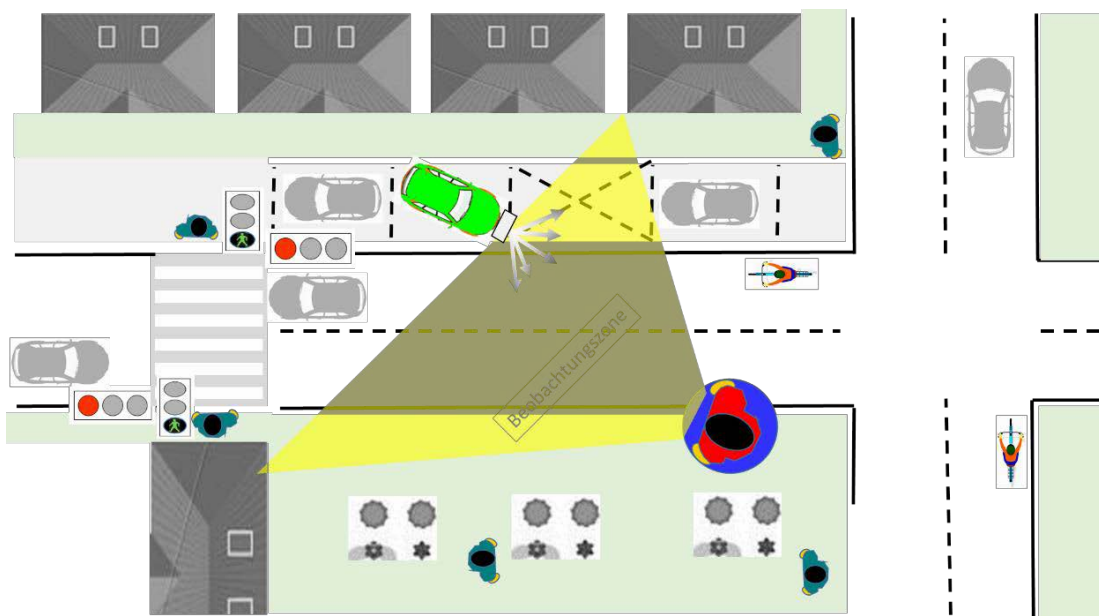
*Figure 1: Schematic Scene for Rear Lamp Animation.*



*Figure 2: Schematic Scene for Daytime Running Lamp Animation.*

The vehicle with animations was positioned within the parking bay in such a way that it was as good visible as possible. This parking position differed significantly from that of the neighboring vehicles and should have already generated attracted higher attention.

The observation situation was chosen so that the traffic light was about 25m from the observation site, the vehicle with animations was only about 12.5m from the observation site. Since the test subjects were supposed to observe the entire scenery, the perception angle fluctuated between 20 and 45 °, depending on the observation direction of the test subject.

*Figure 3: Real scene while filling the questionnaire after DRL Animation*



*Figure 4: Real scene demonstrating Rear Lamp Animation*

## 4.3 Experimental Setup

On the market square next to the test location a farmer's market was present with increased pedestrian and visitor traffic.
The weather situation was about half sunny, half rain.
The visitors and passers-by were approached, asked to be available as a test person and to position themselves on the street for a study.
The test subjects were asked to observe the traffic situation and the road users for one minute.

During this period, 3 animations were carried out for rear lights and daytime running lights. When the animation started, the experimenter made sure that the test subjects had a clear view of the test vehicle despite the circulating traffic from passing vehicles.
The test subjects were subsequent asked with a standardized questionnaire about age group, experience and the evaluation of the situation.

## 4.4 Animations

An Audi e-tron MY2020 was used as test vehicle. The serial standard animation running when the vehicle is unlocked/locked was used. (Figure 5)
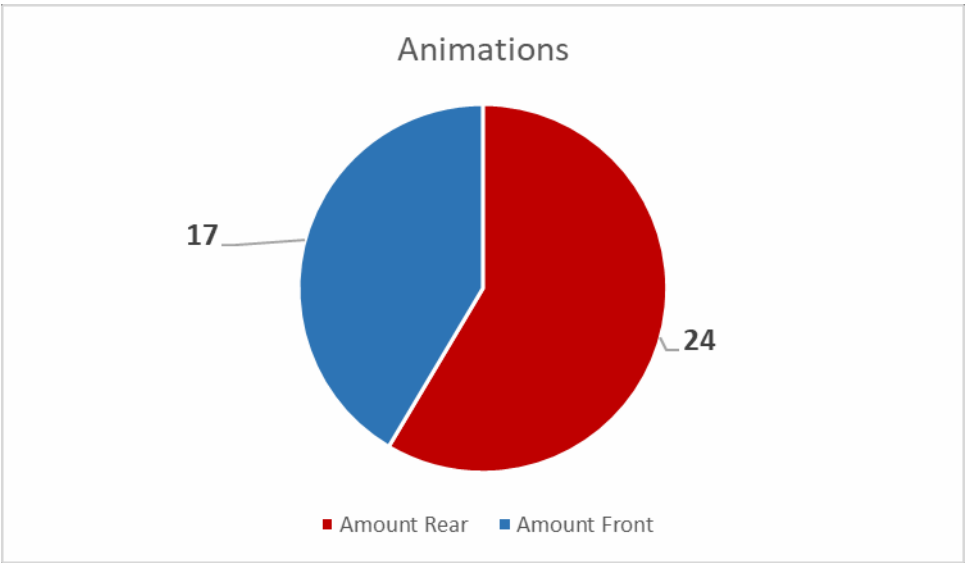
*Figure 5: Animated Areas Front and Rear.*



*Figure 6: Statistical Evaluation of presented animations*

## 5. Evaluation

The evaluation of the standardized questionnaire was divided into the anonymized personal information and the assessment of the situation.

## 5.1    Test Subjects

A total of 41 people, passers-by and visitors to the farmers' market in Kösching district of Eichstätt participated in the study.

The selection of the test subjects from the market visitors resulted in a wide spread of age (Figure 7) and other classifications such as driving performance and pedestrian activity.
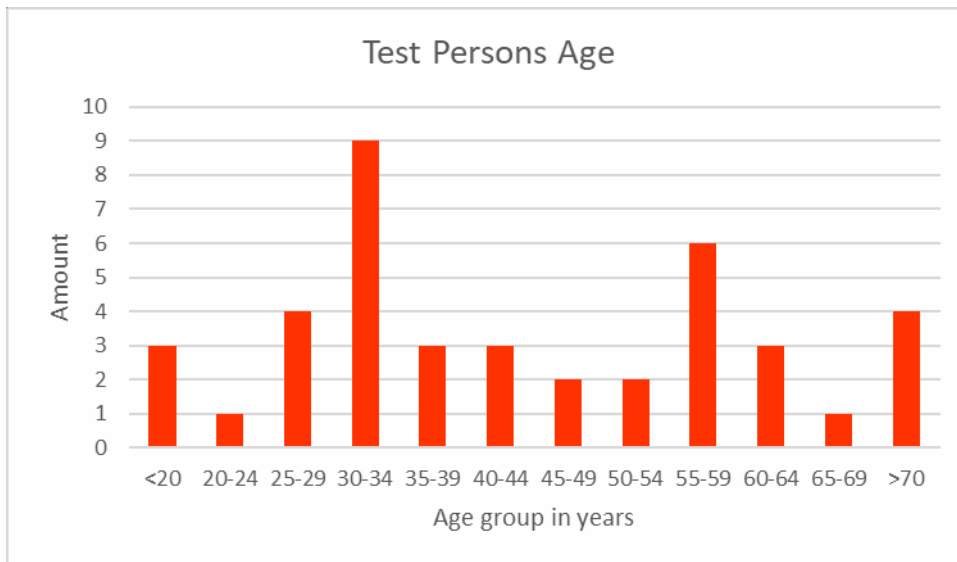The average age was 44 years. In general, the male passers-by were more willing to participate (Fig. 8).
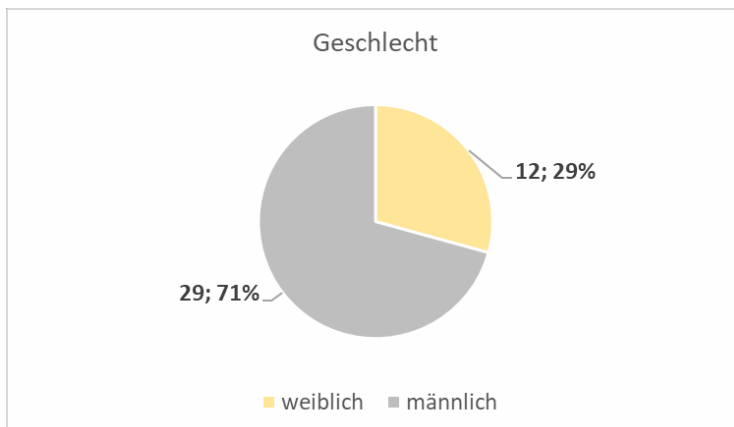


*Figure 7: Age Distribution of Test Persons*



*Figure 8: Statistical Distribution of Gender.*

## 5.2    Traffic experience

In addition to the personal data, the test subjects were asked about their driving experience before the observation phase. For this purpose, the annual driven kilometers (Figure 9) and the activities as pedestrians (Figure 10) were recorded.
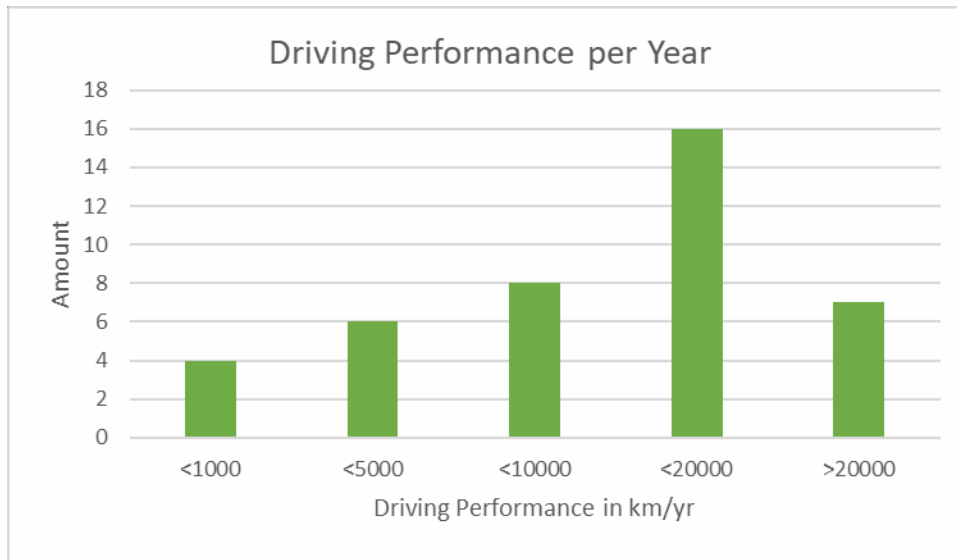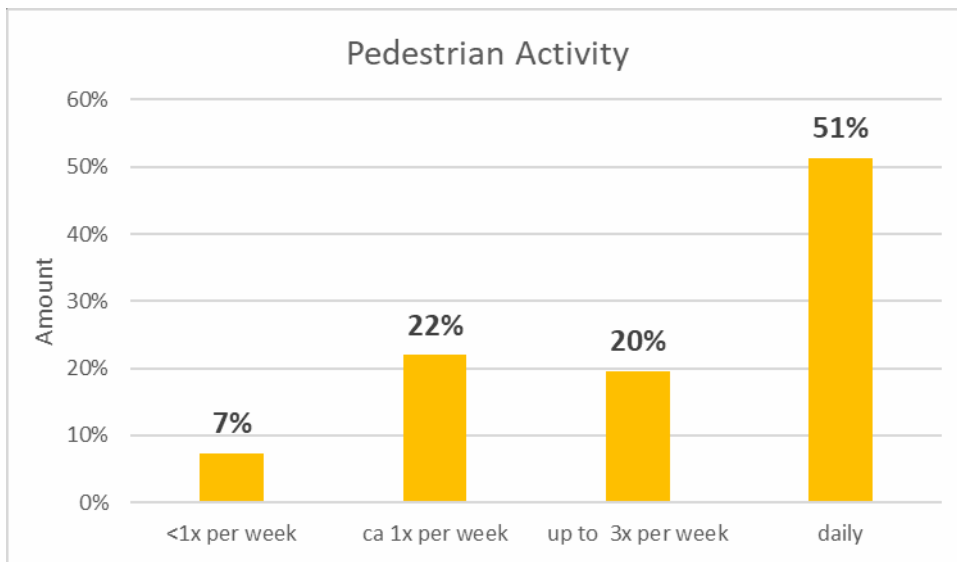
*Figure 9: Annual Kilometers Driven*



*Figure 10: Pedestrian Activity by Test Persons*

## 5.3    Comparison of the data with representative data KBA and BMVI (German Ministry of Transportation)

On average, the test persons traveled about 15,000 km a year. This roughly corresponds to the average mileage that was evaluated by the Federal Motor Transport Authority (KBA) for the years 2014..2018.
For 2018, the KBA gives an average of 13727 km.[i]

The evaluation of the activity as a pedestrian was compared with the available data from the BMVI study "MID: Mobilität in Deutschland" (means "Mobility in Germany")[ii].
The frequency of pedestrian activity was examined in this study. 41% of those surveyed stated that they use footpaths every day, 27% one to three days a week. This results in a total of 68% of pedestrian activities with at least one to three days a week.

By comparing the test persons' data, there is sufficient agreement. 51% said they used footpaths daily, 20% up to 3 times a week.

## 5.4    Traffic analysis data analysis

After the observation phase, the test subjects were asked about their individual assessments of the observed traffic situation. To do this, they were asked to assess the complexity of the situation (Fig. 11 and Fig. 12).
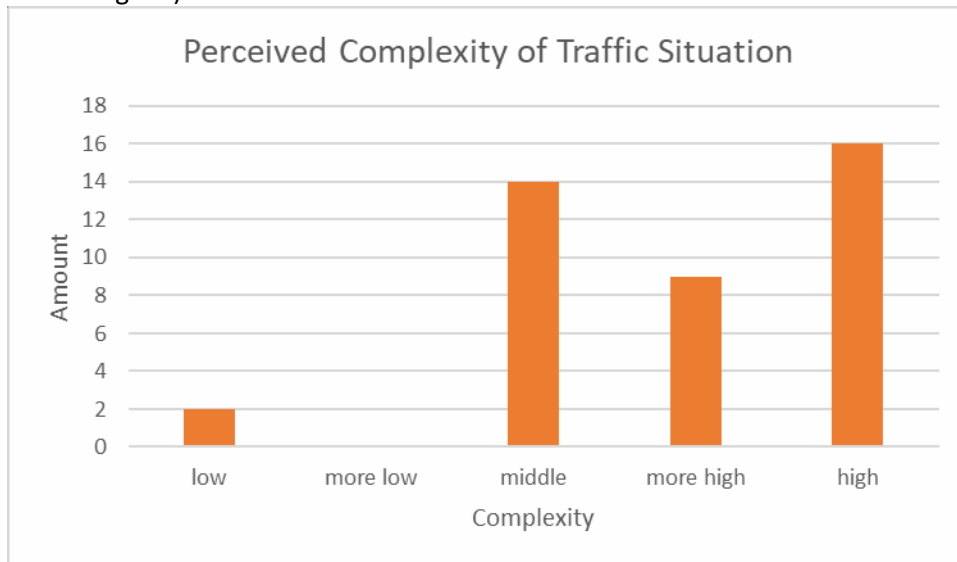


*Figure 11: Evaluation of Test Persons on Perceived Complexity of Situation*
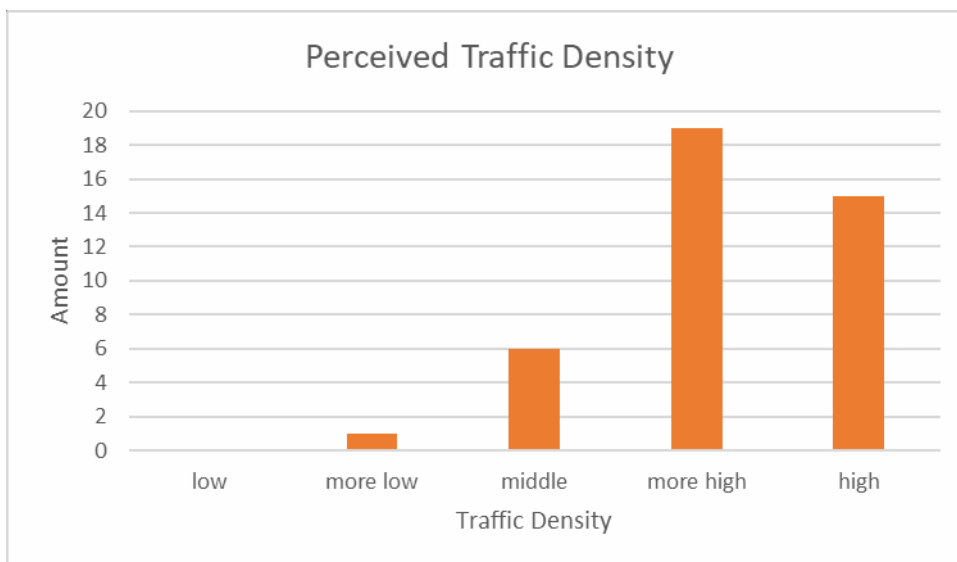*(ref. Fig. 1.. Fig. 4)*



*Figure 12: Evaluation of Test Persons on Perceived Traffic Density*
*(ref. Fig. 1.. Fig. 4)*

The analysis of the information on traffic density and complexity (see Fig. 7..8) shows that the perceived complexity of the situation (see Fig. 1, Fig. 2) with pedestrian crossing, traffic lights and flowing traffic was rated as medium to high. The perceived traffic density was rated as "rather high" or "high"
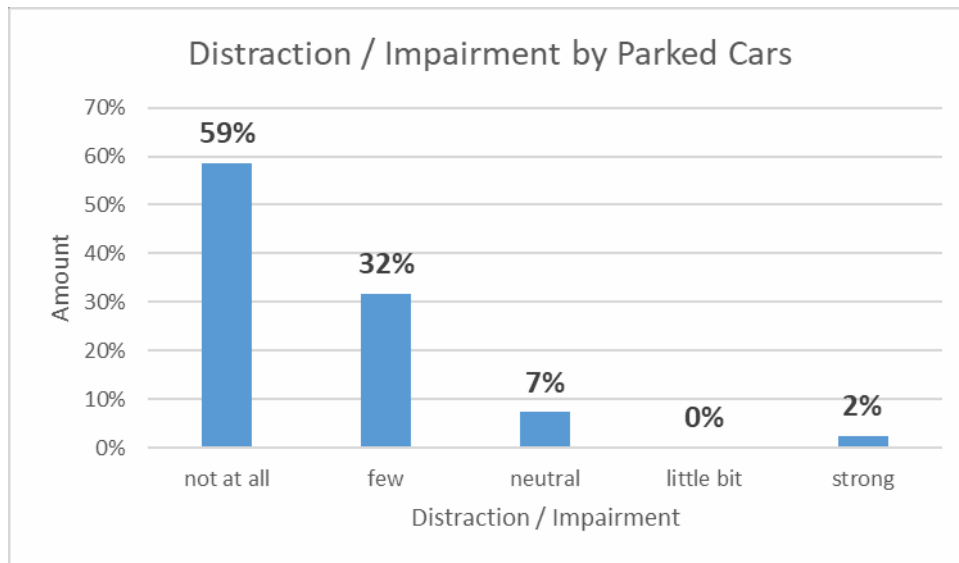
## 5.5 Data Analysis Distraction



*Figure 13: Rating of Test Persons about Distraction and/or Impairment by Parked Cars.*

As part of the survey, the test subjects were explicitly asked, among other questions, whether they were impaired or distracted in any way by parked cars.

The evaluation in Figure 9 gives a clear picture. 91% stated "not at all" or "little" as an impairment or distraction. 7% answered "neutral"

The only test person (2.44%) who felt "severely" disturbed later said he does generally disapprove any parked vehicle in the town center.

The analysis of the subgroups "female" and "male" also showed no significant difference (Fig. 14 and Fig. 15).
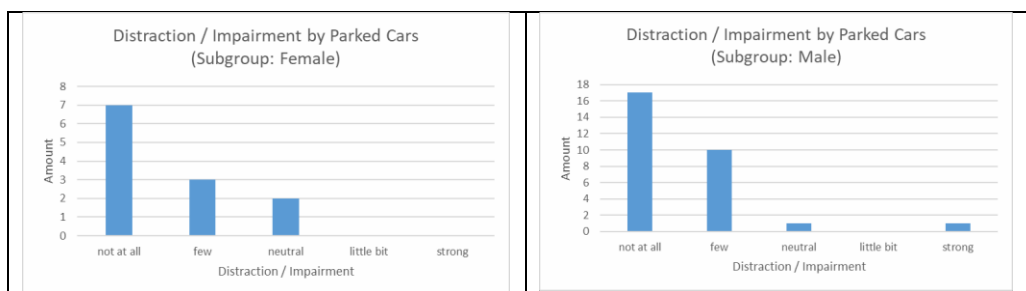


*Figure 14, Figure 15: Rating of Test Persons about Distraction and/or Impairment by Parked Cars. Subgroup Gender Female/Male.*

## 5.6 Data analysis "Conspicuity"

As can be seen in Figure 1 .. Figure 4, the test subjects were in the direct field of vision of the test vehicle, in which the rear or front animation was activated three times during the observation job.

In the further course of the survey, the test subjects were explicitly asked whether they noticed anything about parked traffic. If the answer was positive, the exact cause was asked (Fig. 16).
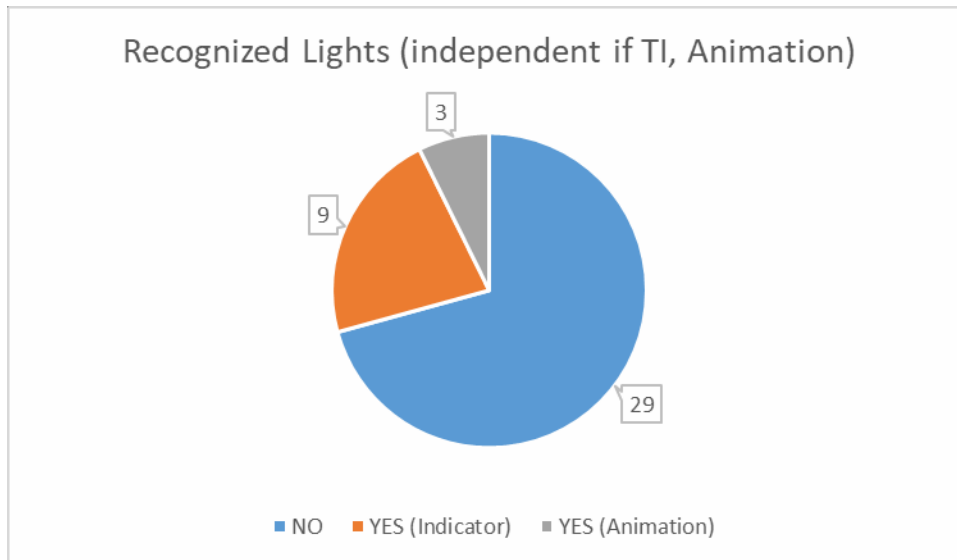
*Figure 16: Test Persons remarks on recognized or conspicuous elements on parked cars.*

Out of the 41 test subjects, 12 (29%) recoginzed something at parking cars (see Fig. 16 and Fig. 17). Out of these, 9 test persons (22%) noticed the indicators lights that activated the opening flashing when the vehicle was opened (before the animation started). This double flashing when the central locking is opened is present in a large part of today's vehicle fleets. Only 3 of the test subjects (7%) remembered the car's animation even when they were explicitly asked about light.
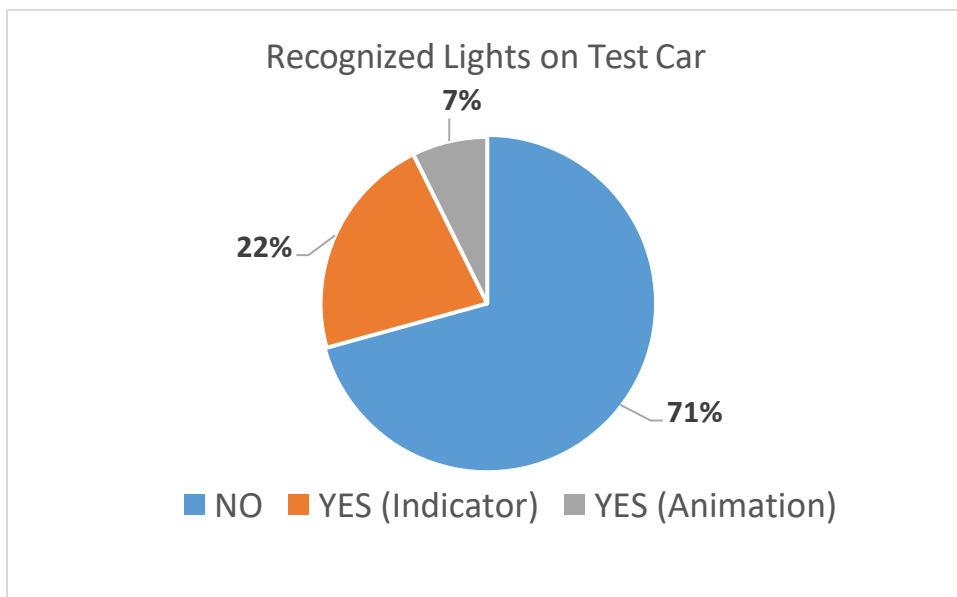


*Bild 17: Statistical Evaluation of Test Persons remarks on recognized or conspicuous elements on parked cars*

## 5.7   Detailed analysis animation

Only 7% out of the subgroup "noticed something" (29%) mentioned the animations.
A detailed analysis was carried out to determine whether the 7% of the test subjects who noticed the animations had felt disturbed or impaired in the previously given assessment.
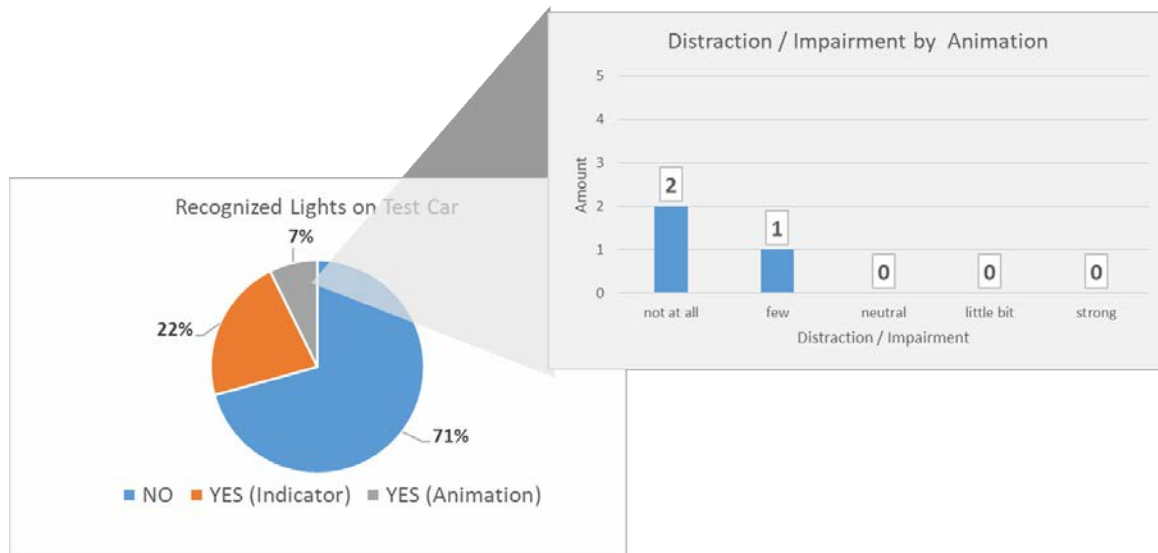
None of the 3 test subjects (7%) who had observed that there was an animation had previously stated that they had been impaired or distracted in any way (Figure 18).

## 6. Summary

The evaluation of the distraction or interference by animations in the front or rear gave a clear and concise picture. Out of the 41 test subjects, 91% stated that they felt little or no distraction or impairment from parked cars during their observation.
A total of 29% of the test persons noticed something conspicuos about the (clearly visible and conspicuously parked) test vehicle. 22% indicated the opening flashing of the central locking system as an observation. Only another 7% noticed the animations in addition to their traffic monitoring.
Of these 7%, 2 people (67%) did not feel disturbed and 1 person (33%)felt little disturbed by the parked vehicles. 0% was the result for "neutral", "something" or "strong".

This indicates that there is no connection between annoyance, distraction or disturbance with animations (coming home / leaving home) by front or rear lighting.
Animations were never found to be disturbing in the study carried out.

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[i] KBA – Statistics about average annual kilometers driven in Germany:
https://www.kba.de/DE/Statistik/Kraftverkehr/VerkehrKilometer/verkehr_in_kilometern_node.html

[ii] MOBILITÄT IN DEUTSCHLAND. Statistics on Mobility for German Ministry of Transportation:
https://www.bmvi.de/SharedDocs/DE/Anlage/G/mid-analysen-rad-fussverkehr-
bilder.pdf?   blob=publicationFile
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