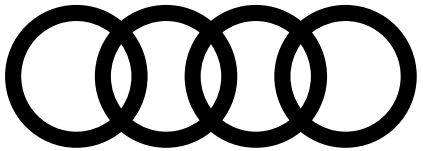


Attention and Distraction by Dynamic Light Functions

Dr. Jonas Kobbert, Dr. Michael Hamm, Christian Hinterwälder – Audi AG

Motivation

- More and more dynamic light functions appear on vehicles
  - Dyanmic turn indicators
  - Coming-Home and Leaving Home Animations
  - Dynamic Bending Light
  - Cornering Light
  - ADB

- What is the current Situation for these animated and dynamic light funcitons?

Agenda

- **Part 1: Study on Impairment of Animation and Sequential Activation**
  - Test Setup
  - Test Persons
  - Statistics on Test Persons
  - Results

- **Part 2: Study on Dynamic Turn Indicators**
  - Test Setup
  - Questionnaire
  - Results

Part 1: Study on Impairment of Animation and Sequential Activation

Hypothesis and Test Location Search

- To test Impairment, we need unbiased test persons
  So laboratory tests are quasi impossible.
- Criterion for Location:
  City Traffic, Traffic Lights,
  Parking Lots, Pedestrians
  Easy access for Test Persons to test area

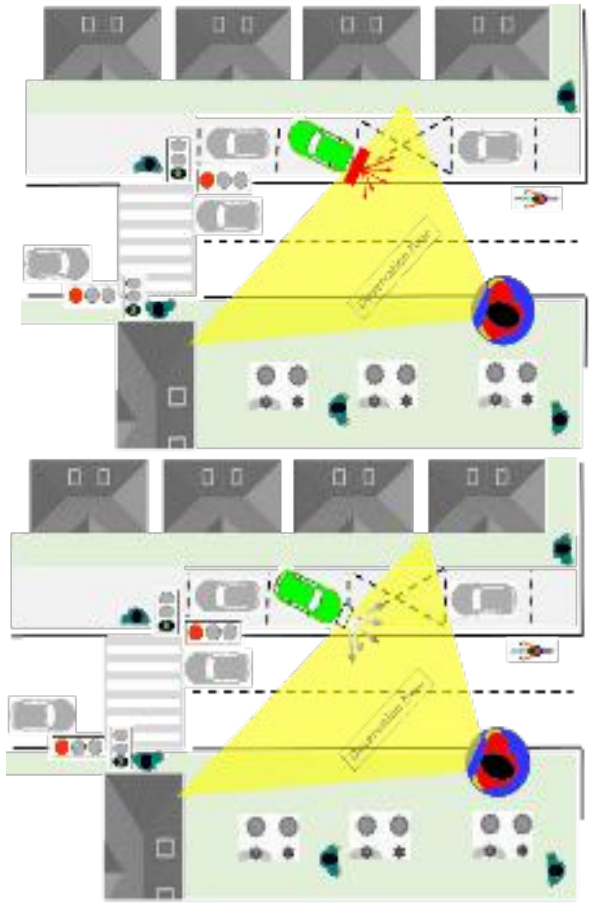
Kösching / Eichstätt district, Bavaria, Germany

Farmers Market Kösching

Part 1: Study on Impairment of Animation and Sequential Activation

Test Setup

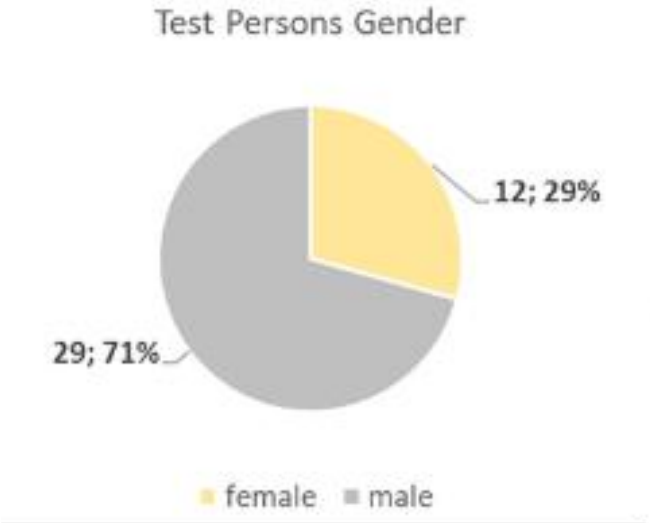
- Scenery with clearly visible car.
- Test persons were asked to “observe the street scenery”
- During session, 3 animations were executed (front/rear)
- Direct after answers on questionnaire were demanded.

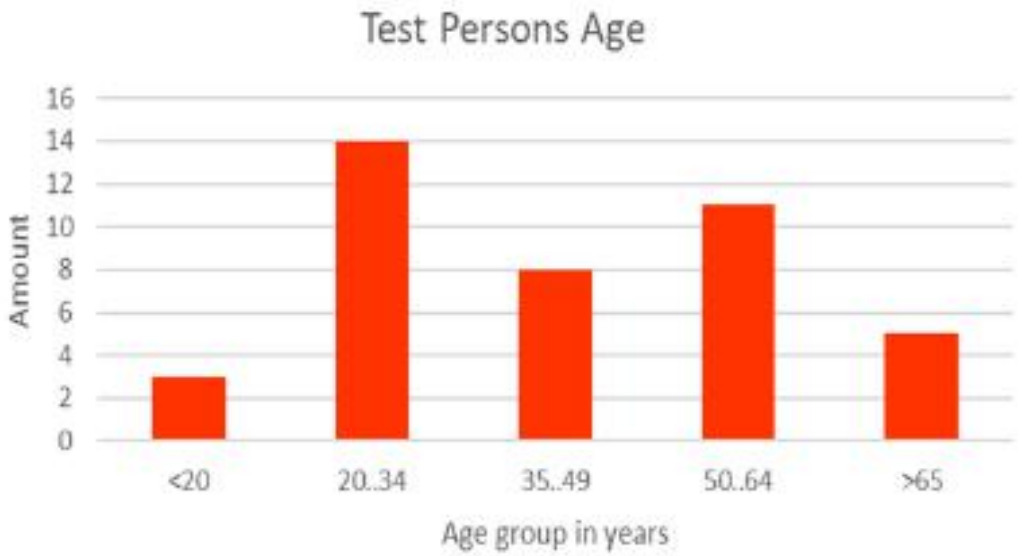


Part 1: Study on Impairment of Animation and Sequential Activation

Test Subjects

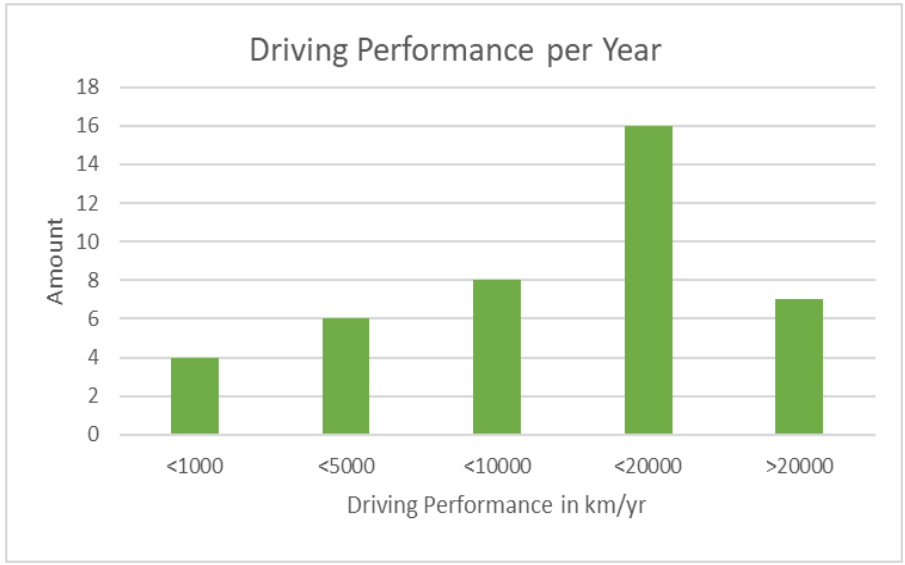
- 41 Test Subjects in total
  - Pedestrians
  - Market Visitors
  - By-Passers





- KBA (German Transportation Administration)=
  Average mileage/a
  13.727 km/a

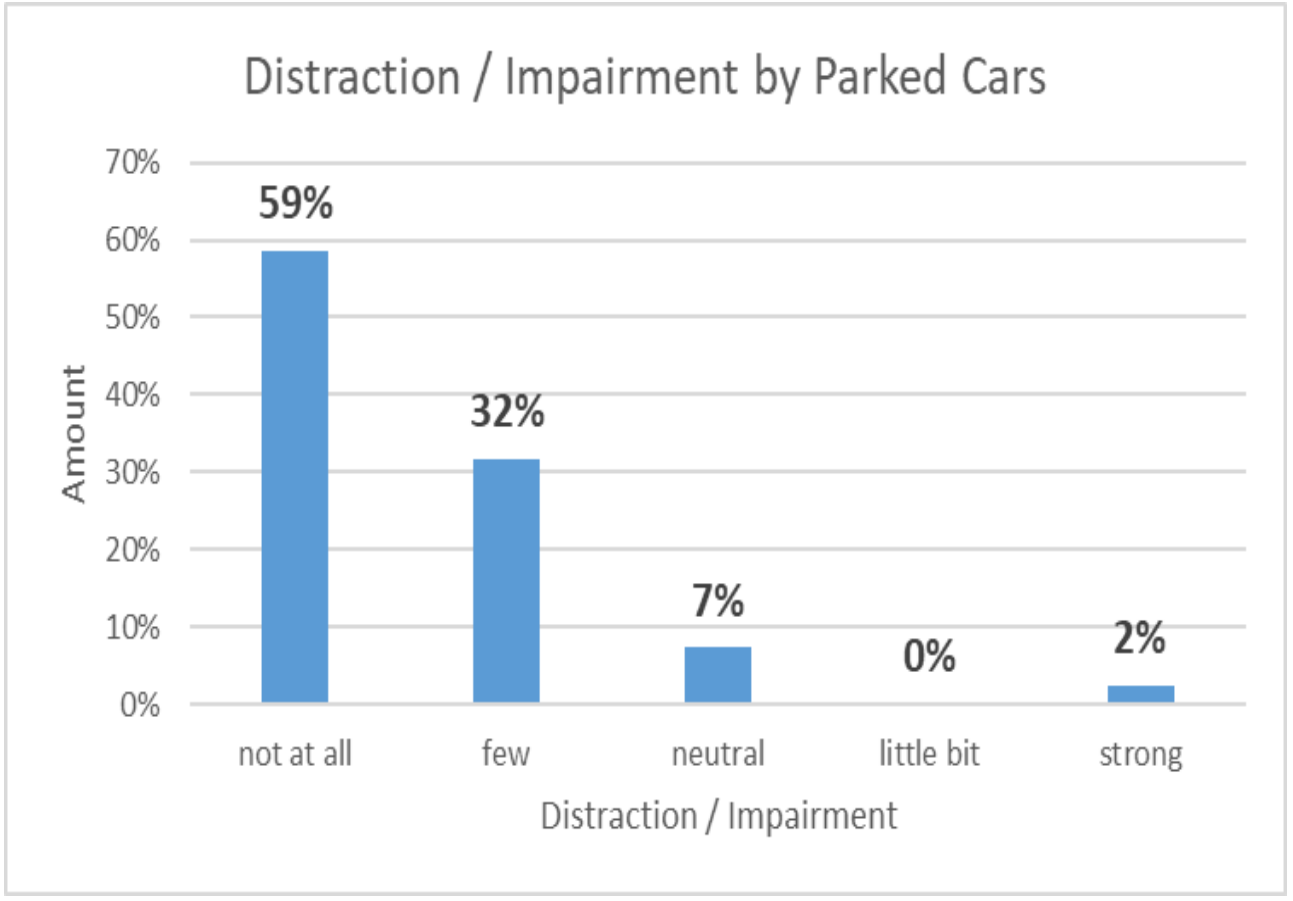
- Average of the Test Subjects: 14.000 km/a



Part 1: Study on Impairment of Animation and Sequential Activation

Results

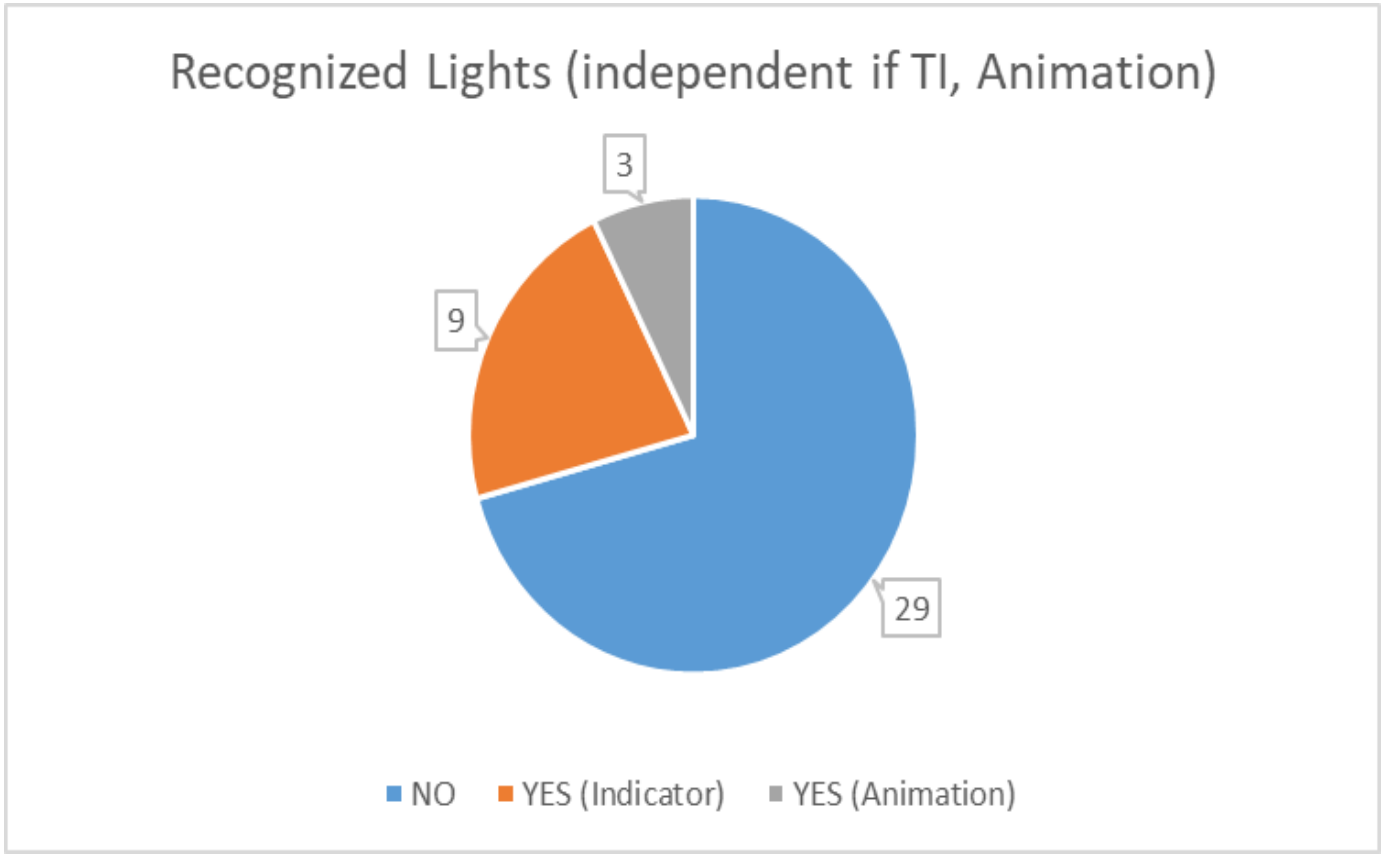
› Have you been distracted or impaired by the parked cars in your view ?



Part 1: Study on Impairment of Animation and Sequential Activation

Results

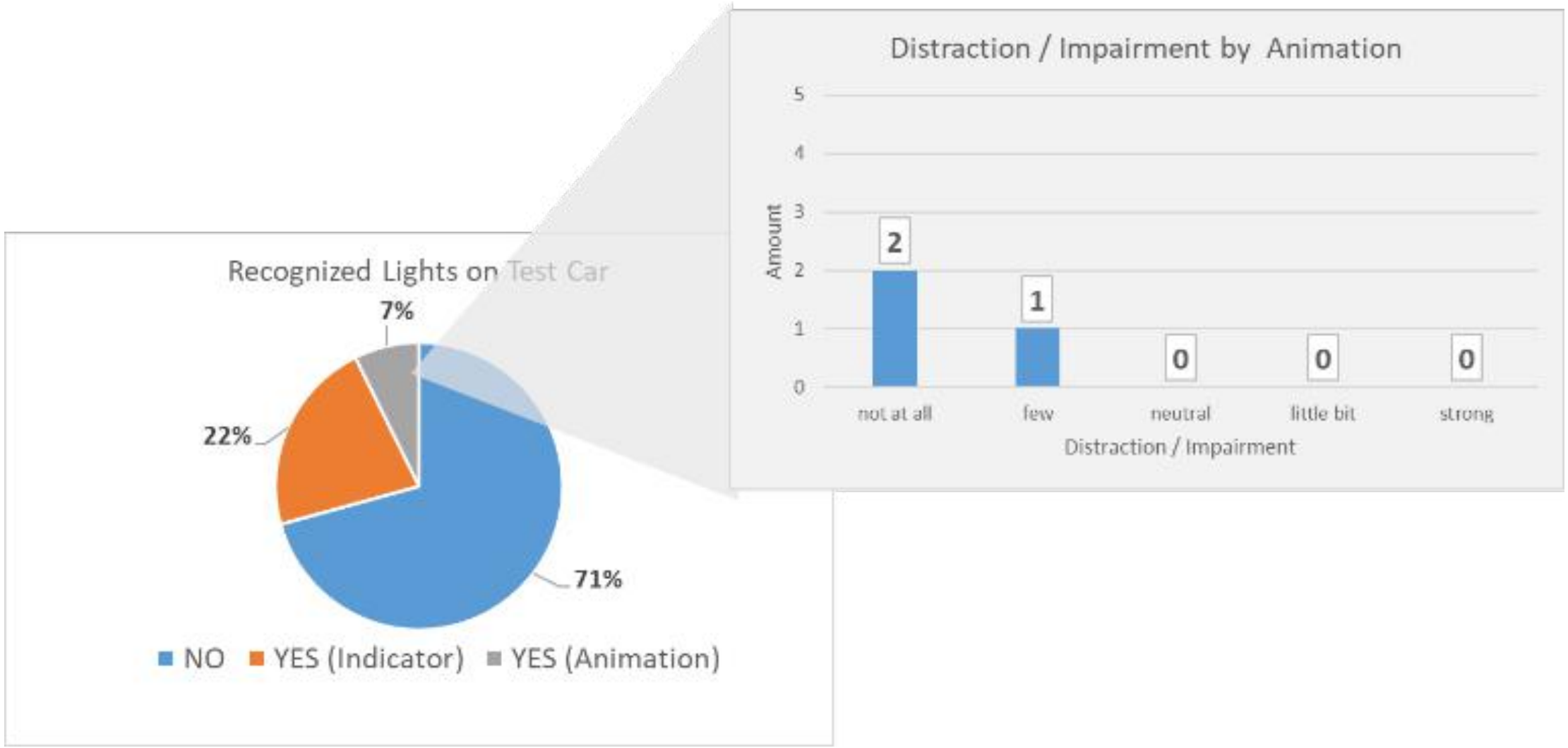
- Question: “In the scenery you just observed: Did you recognize something ?”
- And if “Yes”, “What ?”



Part 1: Study on Impairment of Animation and Sequential Activation

Results

› Combination of Answer “Yes” and Comments on Distraction



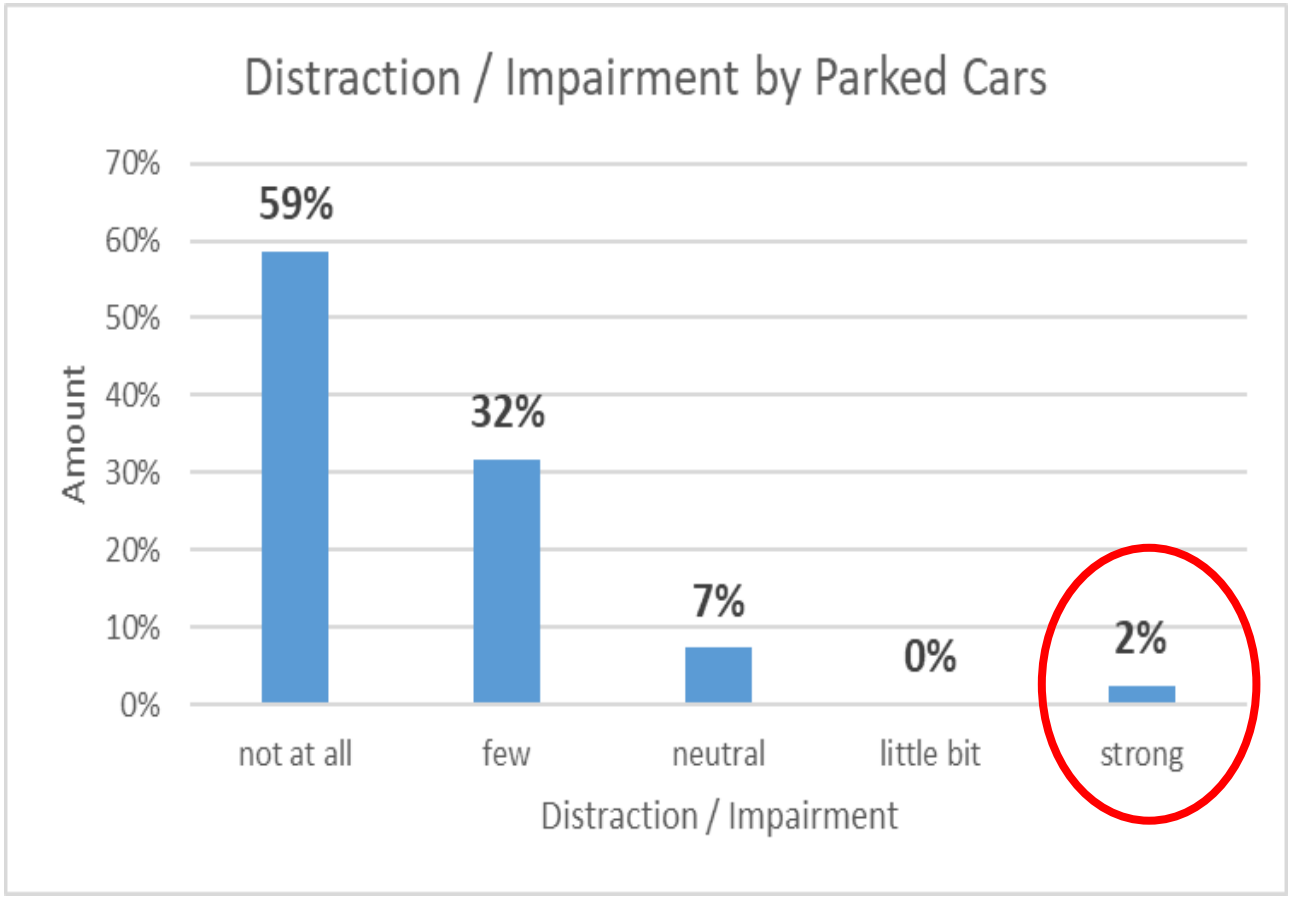
Part 1: Study on Impairment of Animation and Sequential Activation

Results

- 22% recognized the Double Flash of the Turn Indicator while locking/unlocking

- 7% recognized the CH/LH Animations

- We did **NOT find ANY Comment** on Impairment
  There was
  - no distraction
  - no annoyance
  - no disturbance



Part 2: Sequential Activation - Dynamic Turn Indicators

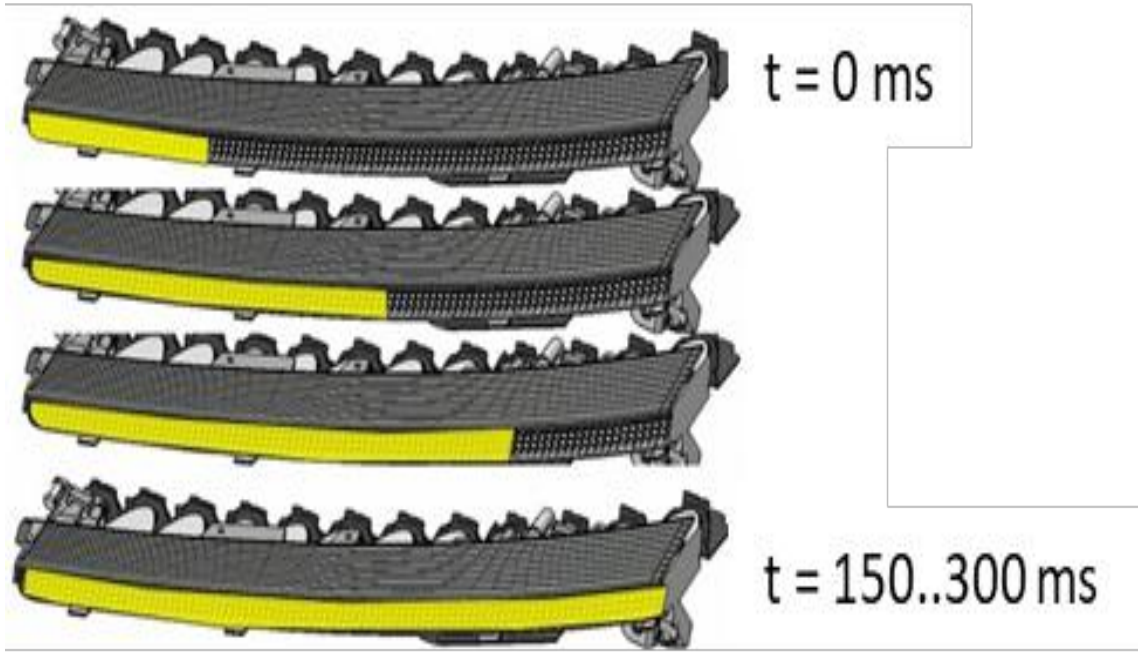
Introduction

- Turn Indicators have long been realised by one bulb
  e.g. (P21W, PY21W, Ph24wy, WY27W etc., etc.)

- Nowadays, Turn Indicators are realized by LED.
  Numbers vary (1, 2, 3……>20.)

- Why not switch the LED on sequentially (one by one) ?

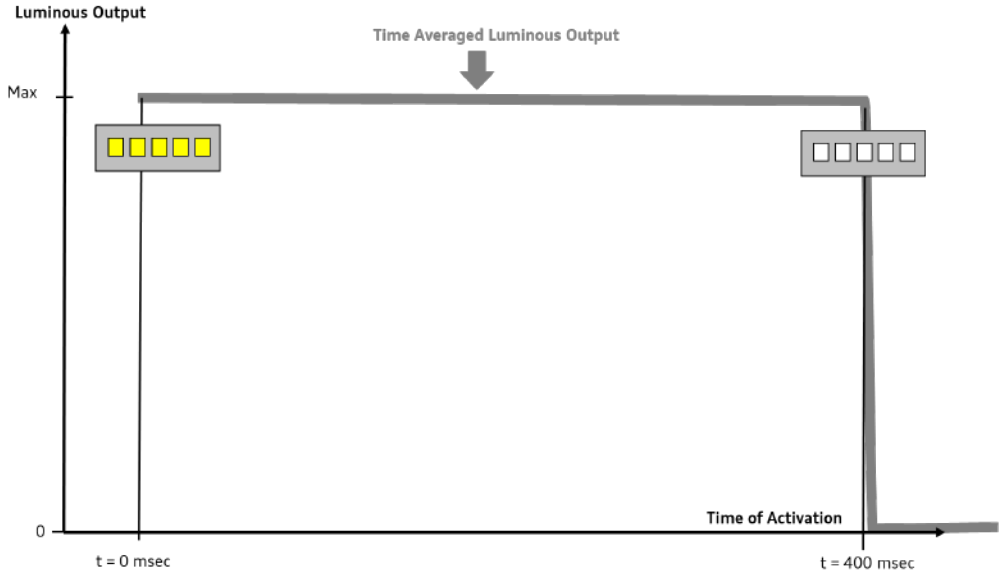
- Which Benefit can be derived from Sequential Activation?



Part 2: Sequential Activation - Dynamic Turn Indicators

Types of TI Activation

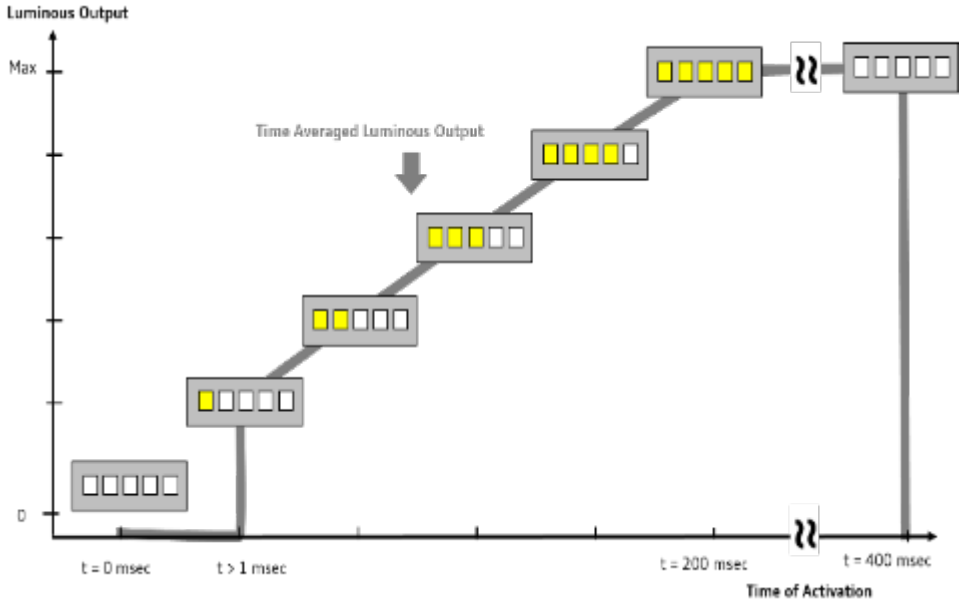
Static



Part 2: Sequential Activation - Dynamic Turn Indicators

Types of TI Activation

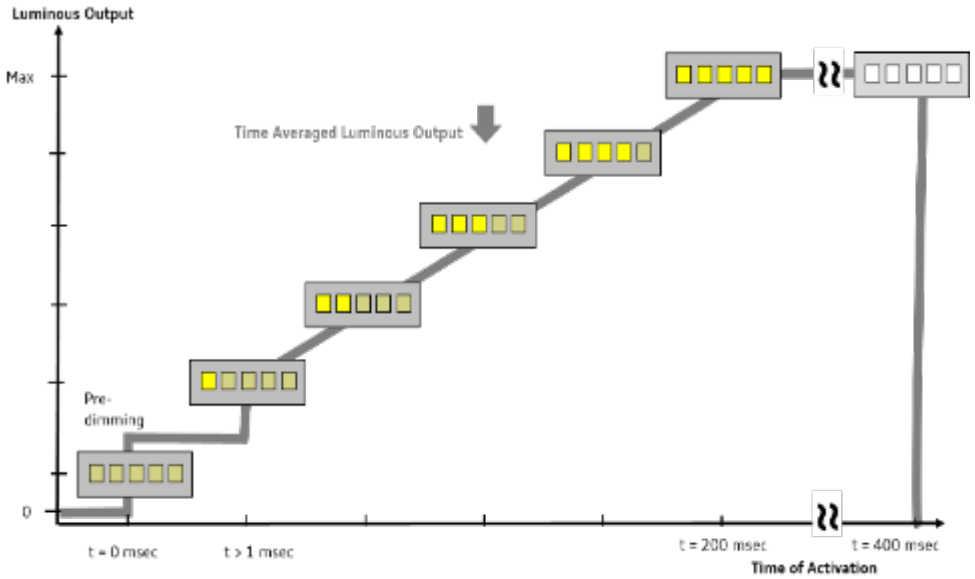
Sequential ON
Dynamic TI



Part 2: Sequential Activation - Dynamic Turn Indicators

Types of TI Activation

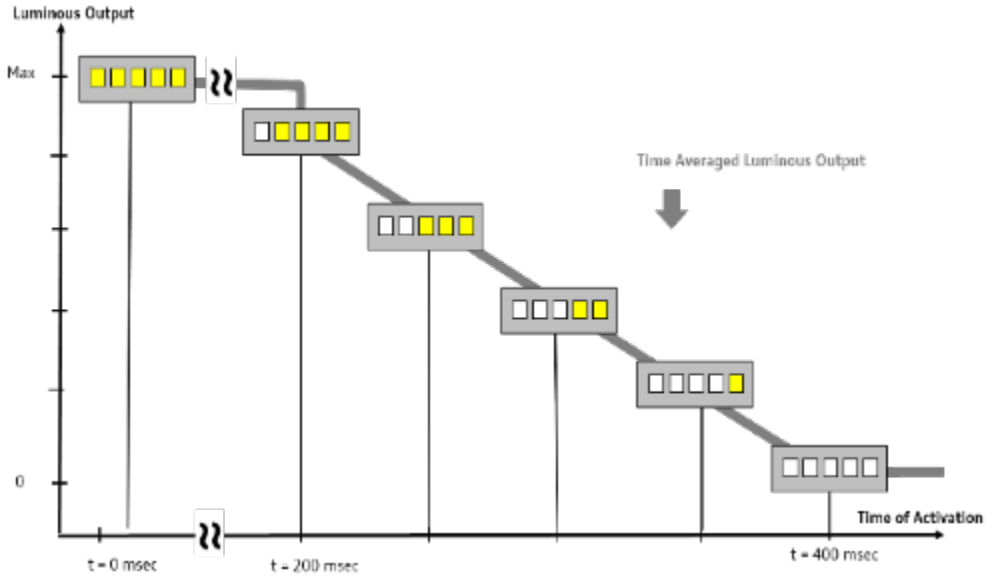
Sequential ON
Dynamic TI
predimmed (EPPLA)



Part 2: Sequential Activation - Dynamic Turn Indicators

Types of TI Activation

Sequential OFF



Part 2: Sequential Activation - Dynamic Turn Indicators

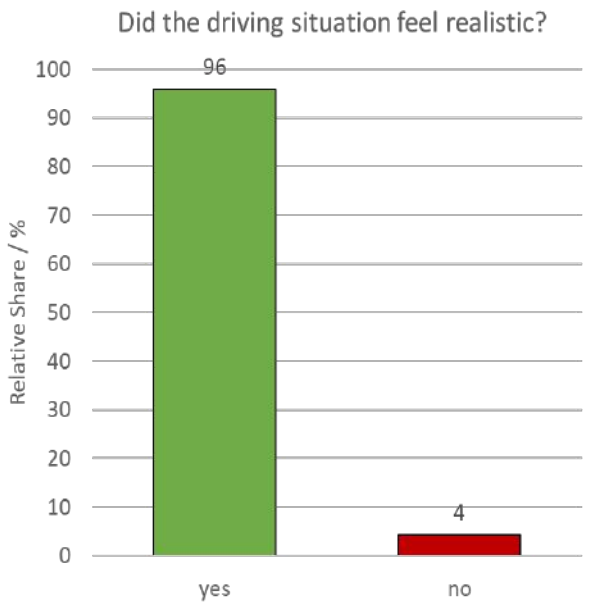
Test Setup

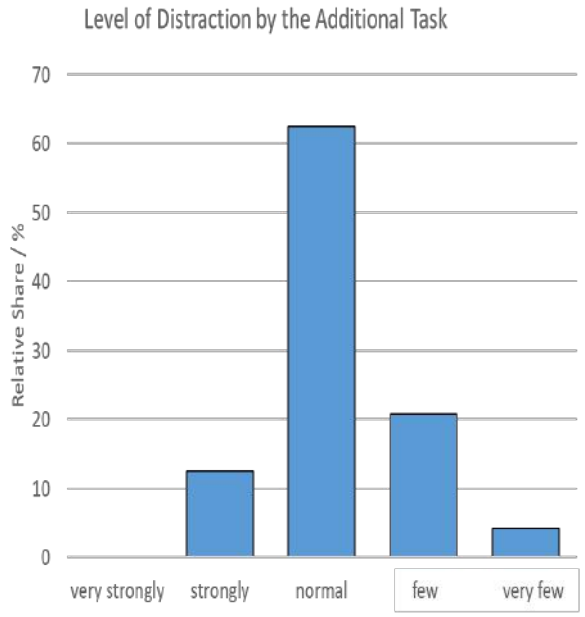
- Test Persons in a real Car
- Front view shows big screen with nighttime dashboard video from Downtown Miami, FL
- Nighttime driving original sound Visual Task was to follow oncoming cars with a cursor
- Silhouette appeared on a separate Video screen (with 4 different TI)
- High Performance Monitor used. Luminance was adjusted to create standard TI illuminance at Test person's eye
- 24 Test Persons
- Each setting 48 TI presentations (4 variants)
- Random positions on screen minimum half vehicle visible

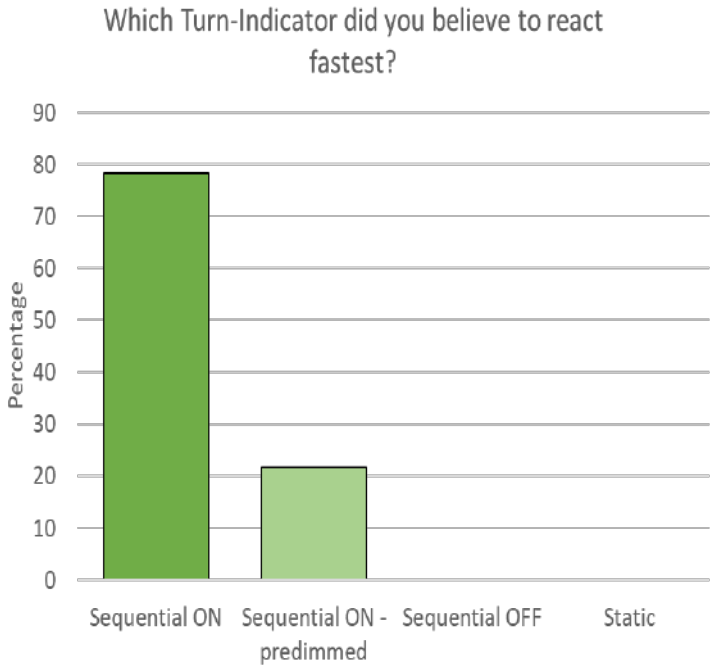
Part 2: Sequential Activation - Dynamic Turn Indicators

General Results

› General Questions regarding the Test Setup and Tasks



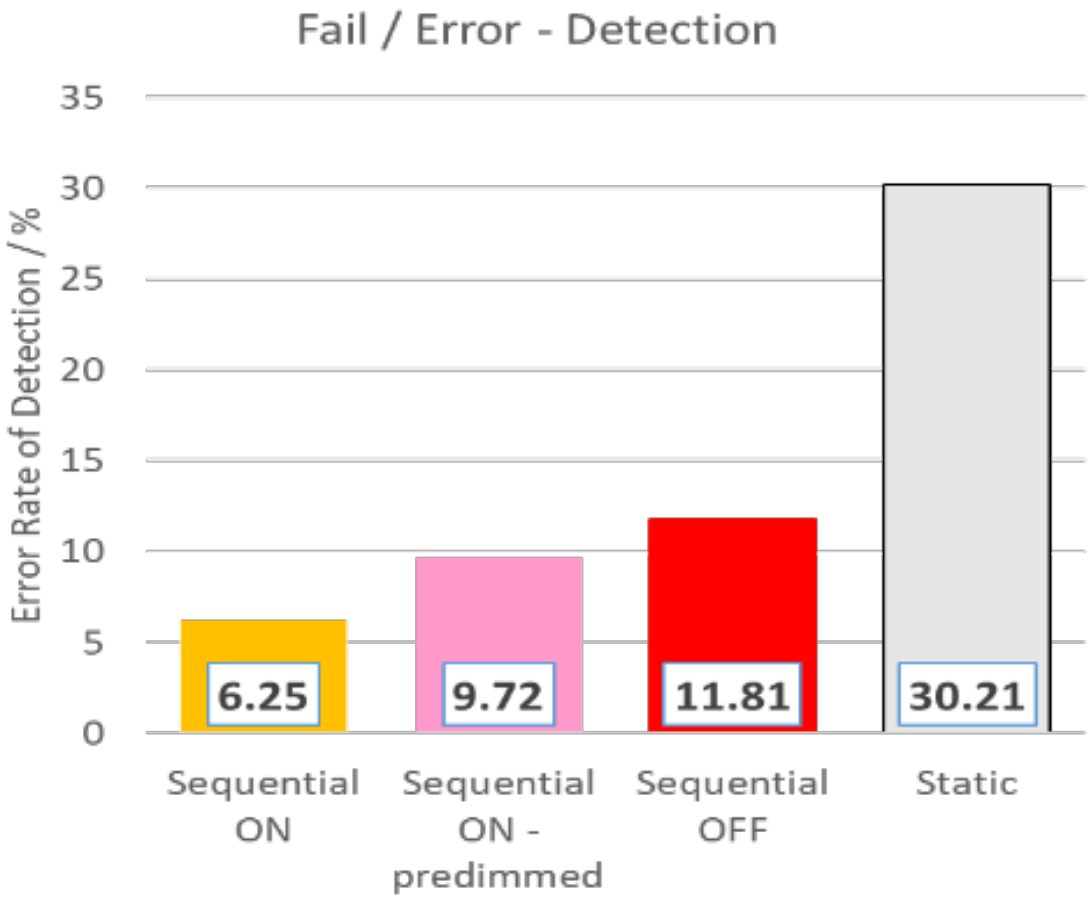




Part 2: Sequential Activation - Dynamic Turn Indicators

Detection Rate and Reaction Times

› How often did the test subject recognize the correct turn direction from only seeing the Direction indicator



Part 2: Sequential Activation - Dynamic Turn Indicators

Detection Rate and Reaction Times

› What are the corresponding reaction times to the different turn signals?

[redacted] [redacted] [redacted] [redacted]

Type of Direction Indication	Sequential ON	Sequential ON (predimmed)	Sequential OFF	Static
Average Reaction time / msec	1.79	1.93	2.1	2.72

Part 2: Sequential Activation - Dynamic Turn Indicators

Summary

- 34% quicker reaction time for Dynamic Turn Indicator (Sequential ON)
- 1 second @40mph (64km/h) equals 18 meters.
- Factor of 5 in correct direction detection (6,25% vs. 30,21%)

Thank you very much

- Special Thanks to
  - Dr. Michael Hamm
  - Christian Hinterwälder