TECHNISCHE FAHRZEUGENTWICKLUNG – AUTOMATISIERTES FAHREN AB 2020?

Dirk Wisselmann.
Würzburg, 17.-18. Oktober 2014
## TECHNISCHE FAHRZEUGENTWICKLUNG – AUTOMATISIERTES FAHREN AB 2020?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Motivation.</td>
</tr>
<tr>
<td>2</td>
<td>Automation and Customer Acceptance.</td>
</tr>
<tr>
<td>3</td>
<td>Roadmap.</td>
</tr>
<tr>
<td>4</td>
<td>Challenges.</td>
</tr>
<tr>
<td>5</td>
<td>Future Steps.</td>
</tr>
</tbody>
</table>
AUTOMATED DRIVING WILL INCREASE SAFETY, COMFORT AND EFFICIENCY BOTH FOR THE DRIVER AND THE TRAFFIC SYSTEM.

**IMPROVED TRAFFIC AND DRIVING SAFETY.**

- Always safe (also without automation by an optimized perception).

**INCREASED DRIVING COMFORT.**

- Gaining valuable time by delegation.

**IMPROVED DRIVING EFFICIENCY.**

- Time and fuel savings through optimized driving strategy.
AUTOMATED DRIVING ENABLES THE DRIVER TO DELEGATE DRIVING TASKS. THE ENVIRONMENT PERCEPTION INCREASES HIS COMPETENCE AND THE ACTIVE SAFETY PROTECTS HIM.

Delegation

- My car drives and parks itself
- My car drives me when I want it

Competence

- My car has a 360° view and reacts intelligently
- My car is my co-pilot and knows more than I

Protection

- My car protects me (and others) and avoids accidents
- My car protects itself, no more dents and scratches

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AUTOMATED DRIVING IS THE BASIS TO INTEGRATE SINGLE FUNCTIONS TO AN OVERALL EXPERIENCE.

Integration of single functions + Increasing degree of automation + Backend for advanced perspective = Customer oriented use cases
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THE DUALISM OF AUTOMATION: INCREASE OF COMFORT, SAFETY AND EFFICIENCY VERSUS LOSS OF COMPETENCE?

Manual Driving „only“

Automated Driving

Comfort, Safety, Efficiency (& Pleasure)

Manual Driving

Joy, Competence (& Comfort, Safety, Efficiency)
WITH THE AUTOMATION THE CUSTOMER HAS TO DEVELOP AND ACCEPT A NEW ROLE MODEL.


Automated Driving: New experience of relaxation in boring situations.
FIRST STUDIES SHOW THAT HIGHLY AUTOMATED DRIVING WILL BE ACCEPTED BY THE CUSTOMER BUT WE HAVE TO CONVINCE THE SOCIETY, TOO.

“The industry is developing autonomous vehicles. Could you imagine driving such a car if you were able to intervene in the case of an emergency?”

Results of a survey of 1,000 customers with a German driver’s license:

- Yes. 25
- Yes, perhaps. 41
- No, that’s unlikely. 18
- I am not sure. 4
- Absolutely not. 12

>> For two thirds of the drivers an autonomous car would be an option.

(Source: Ernst & Young GmbH, Study „Autonomous Driving“, 2013, provided by research partner Continental AG)

The society’s hopes and concerns:

- Sustainable and individual mobility:
  - Technology has better reaction time
  - Car sharing
  - Solution for increasing traffic volume
  - Cooperative behavior
  - Swarm accidents
  - Less wasted space for parking
  - Innovative strength of the economy
  - Mobility for all
  - Loss of driving competence
  - Rise of productivity via efficient traffic
  - Compliant to traffic rules
  - The role of humans in the world of robotics
  - Data error
  - Data security
  - Safe traffic in spite of „always on“
  - Relaxed traffic flow

(Source: BMW Group Research and Technology, Online-Media Analysis „Social perception of highly automated driving“)
## THE STEPWISE INCREASE OF AUTOMATION HELPS CUSTOMERS AND SOCIETY TO UNDERSTAND AND TO ACCEPT THE NEW FUNCTIONALITY.

<table>
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<tr>
<th>Level 0</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Level 5</th>
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<tbody>
<tr>
<td>Driver only</td>
<td>Assisted</td>
<td>Partial Automation</td>
<td>Conditional Automation</td>
<td>High Automation</td>
<td>Full Automation</td>
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**Vehicle guidance**
- **System** cannot assume neither longitudinal nor lateral control; control remains with the driver.
- **System** assumes either longitudinal or lateral control
- **System** accomplishes both longitudinal and lateral control

**Monitoring task**
- Not applicable
- **Driver** must monitor the system at all times. Activities not related to driving are not permitted.
- **Driver** does not have to monitor the system at all times. Activities not related to driving are possible to a limited degree
- **Driver** is not required to monitor the system. Driver may perform activities not related to driving at all times.
- No driver required.

**Performance limits**
- Not applicable
- **System** is not capable of recognizing all of its performance limits. This lies in the responsibility of the driver.
- Whenever the **system** recognizes its performance limits, driver will be requested to resume control.
- **System** recognizes its performance limits. Emergency situations can be accomplished by the system, provided that they can be managed similarly by a human driver …
- … during defined use case
- … during the whole journey
- **System** is not capable of transferring to the minimum risk condition out of each situation. Therefore it requests the **driver** to resume vehicle control with sufficient time margin.
- **System** can cope with all situations automatically.
- … during defined use case
- … during the whole journey
- At the end of the use case the **driver** is requested to resume vehicle control.

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# BMW ACTIVE ASSIST – THE ROADMAP TO AUTOMATED DRIVING.

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FIRST FUNCTIONS OF PARTIAL AUTOMATION ARE AVAILABLE. SPECIFIC SEGMENT SOLUTIONS ARE FEASIBLE BY SCALING.

- Mono camera
- Up to 140 km/h
- First ACC system in UKL1

- Traffic Jam Assistant up to 60 km/h
- Mono camera

Active Cruise Control

- Radar and Mono camera
- Up to 210 km/h
- Emergency Braking

Traffic Jam Assistant

- Traffic Jam Assistant up to 60 km/h
- Data fusion of radar sensor and mono camera

Night Vision mit Dynamic Light Spot

- FIR camera
- Recognition of pedestrians and animals
- Lightspot on critical objects

High-beam assistant

- Enlighting the whole road without dazzling other vehicles
PARKING SYSTEM ARE FURTHER DEVELOPED TO AN INTUITIVE OVERALL EXPERIENCE.

Parking maneuver assistant with longitudinal and lateral guidance

Surround View from four cameras

Panorama sideview with front camera
BMW ACTIVE ASSIST – THE ROADMAP TO AUTOMATED DRIVING.

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MASTERING THE BASIC TECHNOLOGIES IS THE FIRST STEP FOR HIGHLY AUTOMATED DRIVING.
READY FOR THE MARKET MEANS THE AVAILABILITY OF A HIGH-QUALITY, DIVERSE AND AFFORDABLE SENSOR-SETUP.
FUSION AND SITUATION INTERPRETATION IN THE ENVIRONMENTAL MODEL REQUIRES HIGH-COMPUTING PERFORMANCE.

**REPRESENTATION**

- Model based objects
  - Detection and fusion of dynamic objects
  - Estimation of velocity and acceleration
  - Object classification
  - Advanced cognitive prediction

- Occupancy maps / free space
  - Model-free environmental representations
  - Static obstacles
  - Extraction of free space / road boundary

- Road model
  - Precise road geometry and road network
  - Lane markings, road boundaries
  - Identification of possible routes

**LOCALIZATION**

- Fusion of local and global positioning

- Sensor road model
  - Lane detection
  - Landmark detection

- Global location determination
  - Multilane, high-precision digital map with landmarks
  - GPS
  - Odometry

- cm-accurate, redundant and highly available localization on the motorway
THE BACKEND IS AN ESSENTIAL PART OF OUR ARCHITECTURE.

Coverage of selected countries of 100,000 selected BMW ConnectedDrive vehicles:

Roads passed by 1 - 3 vehicles within 10 days
**BMW ACTIVE ASSIST – THE ROADMAP TO AUTOMATED DRIVING.**

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STARTING FROM 2020 FIRST HIGHLY AUTOMATED DRIVING FUNCTIONS COULD BE OFFERED TO OUR CUSTOMERS.

Development of an electronic co-pilot system with the international automotive supplier Continental.

Limited field test of highly automated driving functions in Germany and Europe (BMW Group & Continental).

Quantified benefits through large scale field operational test of highly automated driving functions (OEMs/suppliers).

Global rollout of highly automated driving functions.

THANK YOU VERY MUCH FOR YOUR ATTENTION.