



Realisierung einer positiven User Experience mittels benutzerfreundlicher  
Ausgestaltung des Innenraums für automatisierte Fahrfunktionen

Gefördert durch:



aufgrund eines Beschlusses  
des Deutschen Bundestages

# Development of New Driving Devices

RUMBA-Abschlusspräsentation

Renningen | 24.04.2024

# Driving Experience of the Future


How will we drive?





# Driving Experience of the Future


## Steer-by-wire


★★★  
innovative  
functionalities

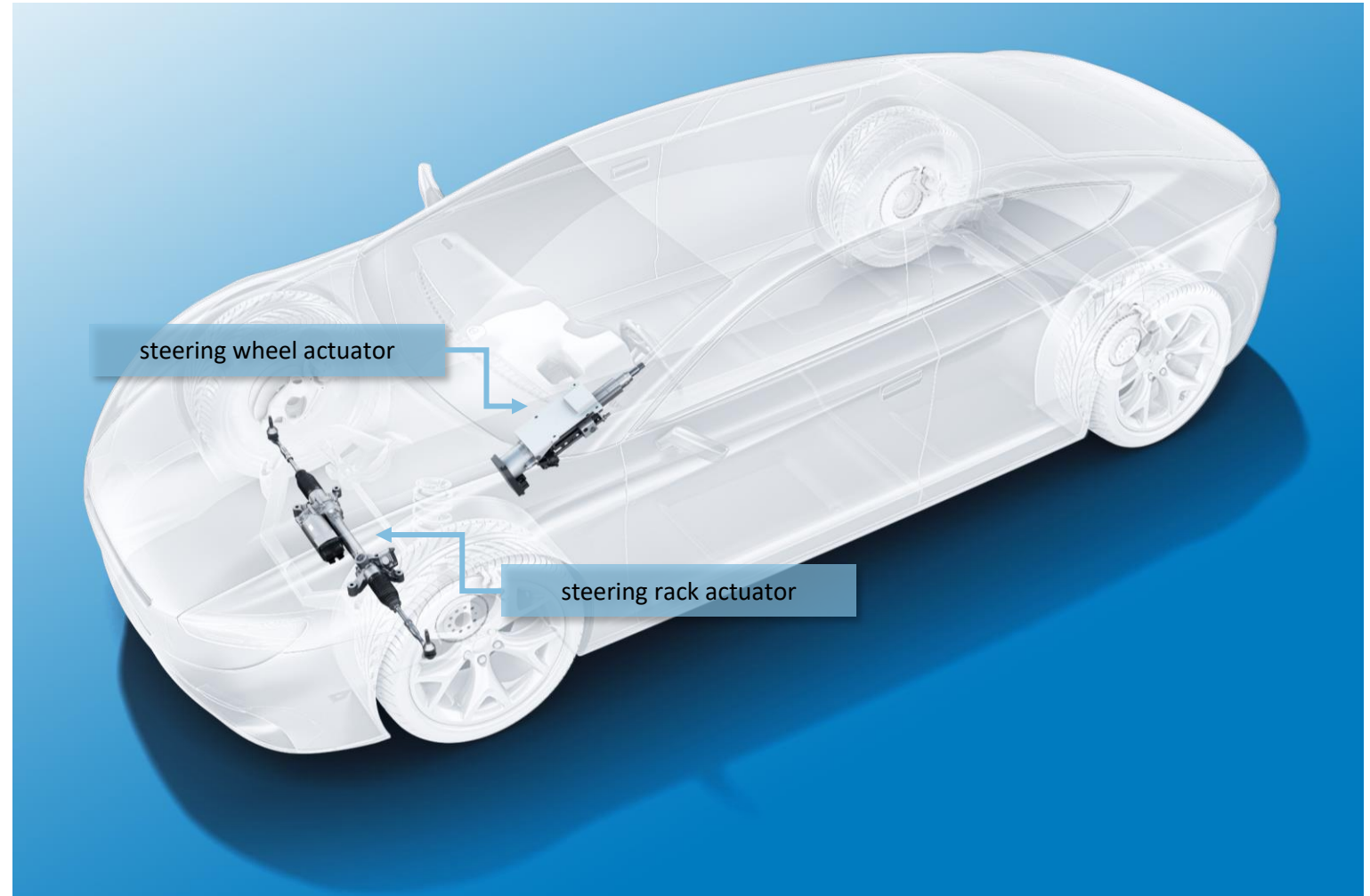
 exciting  
user experience

automated  
driving 

mounting &  
packaging space 

cost reduction 

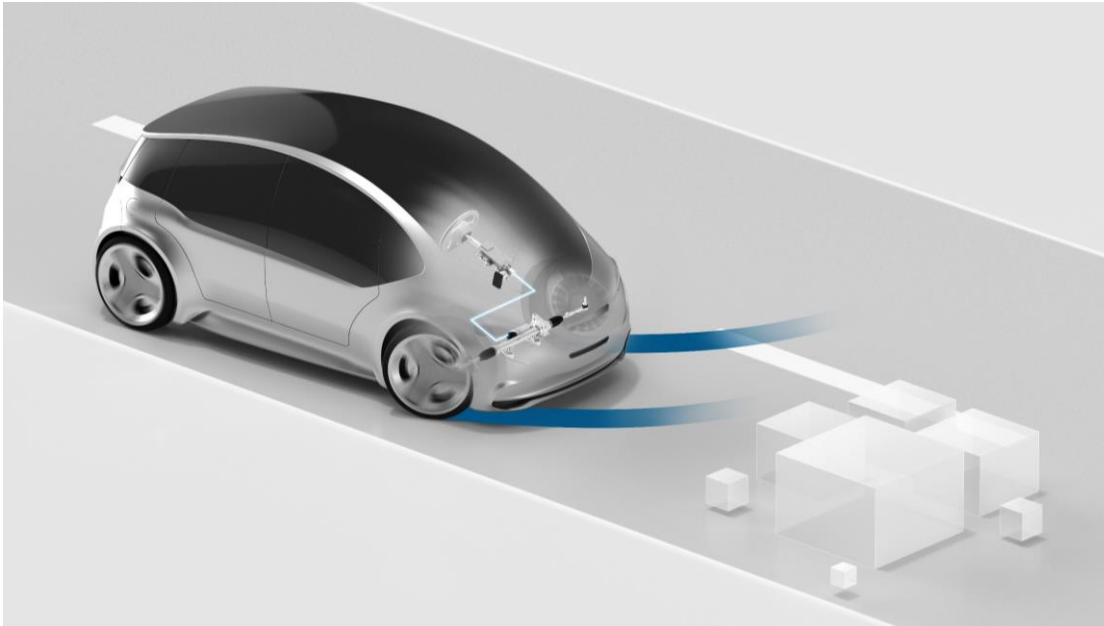
new interface &  
interior design 



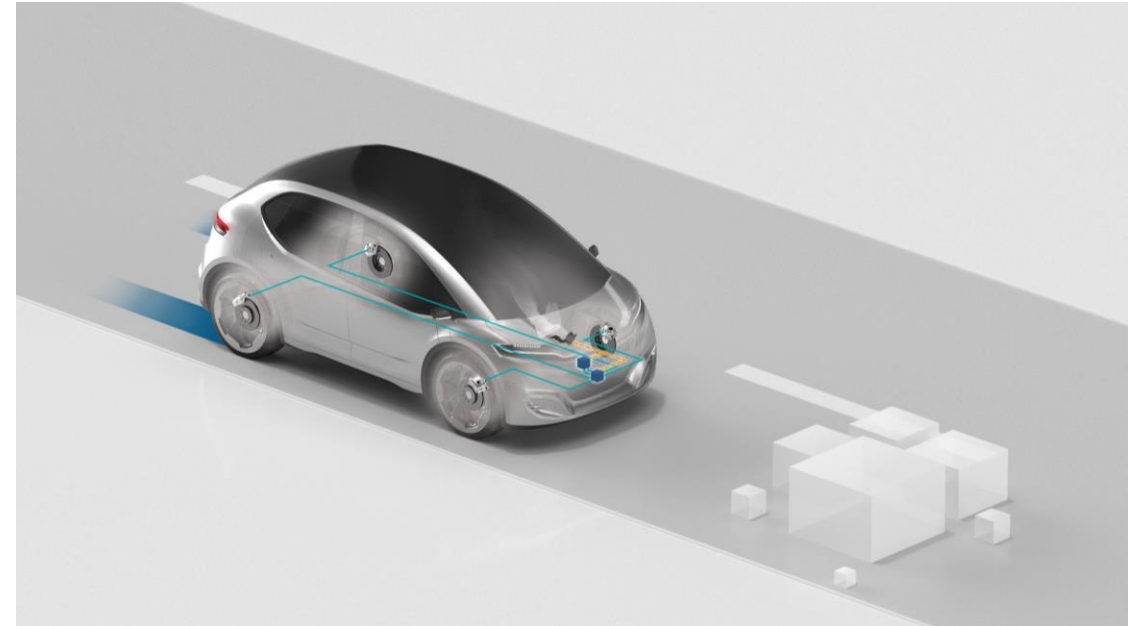
# Driving Experience of the Future

## Act-by-wire

### Steer-by-wire






### Brake-by-wire



Act-by-wire technology enables innovative functions and features.

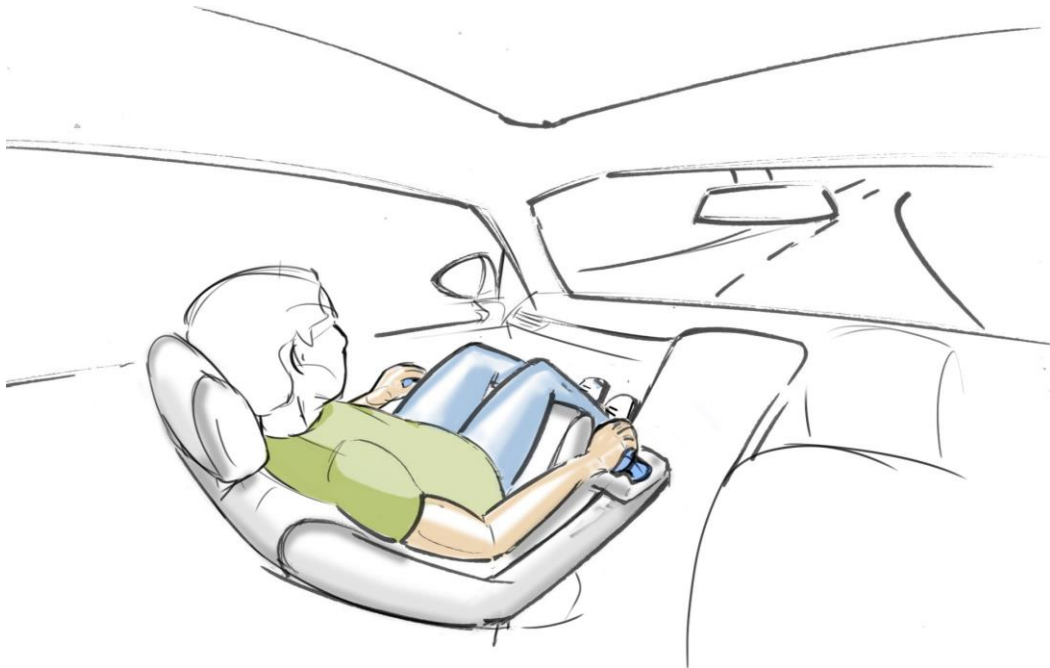
# Driving Experience of the Future

## Act-by-wire

Interface design	Automated driving	Driving experience
		
<p>Do we still need a <b>steering wheel</b>?</p> <p>Do we still need <b>foot pedals</b> for accelerating and braking?</p>	<p><b>Safe</b> and <b>comfortable</b> ride</p> <p><b>Interior space</b> for relaxing or other activities</p> <p>Easy and fast <b>transition</b> to the adjusted interior and back</p>	<p><b>Comfortable, fun, and safe</b> driving</p> <p><b>Accessible</b> and <b>adjustable</b> for all drivers</p> <p><b>Personalized</b> driving</p> <p><b>Flexible</b> plug and play solution</p>

# Driving Experience of the Future

## Vision



- **Function**
  - By-wire driving HMI with joystick-like devices
- **Features**
  - Controlled steering feel with force feedback actuator
  - Integrated operation of braking and accelerating
- **Customer benefits**
  - New dimension of driving experience and fun to drive
  - Driving comfort in narrow curves and parking situations
  - Enabling new interior concepts

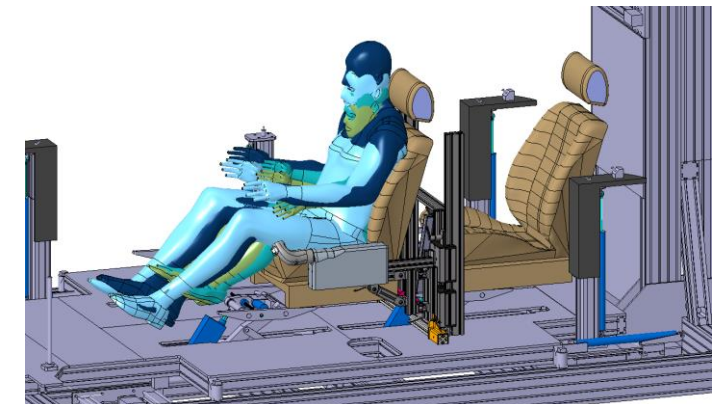
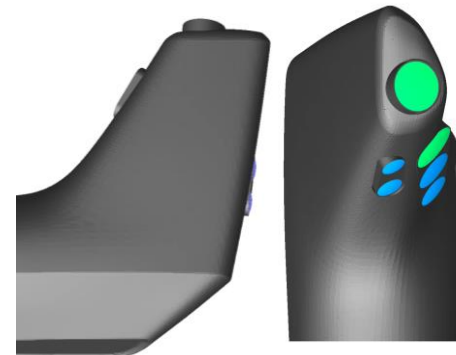
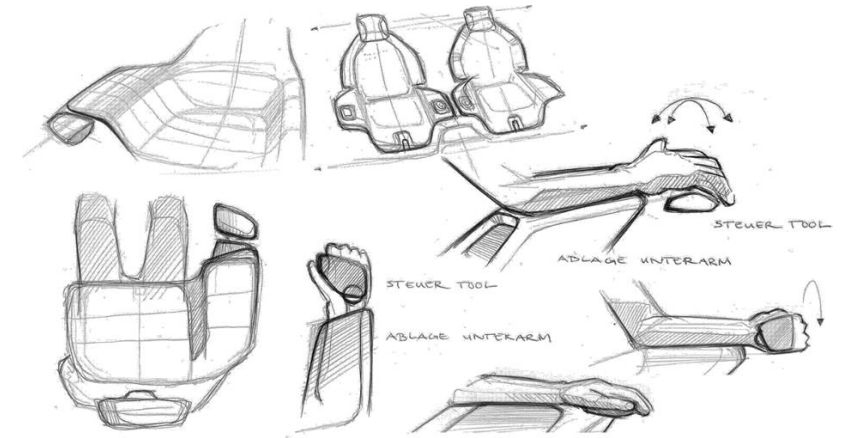


# New Driving Devices

## Design & functions

How should the device look like? Which functions are needed?

- Expert workshop: **Functions and design**
  - Sketches, clay models, CAD models, 3D printed models
- Simulator study: **Ergonomics and operability (N = 34)**
  - Evaluation of longitudinal control concepts
  - Integration of secondary tasks
  - Adjustments of the devices



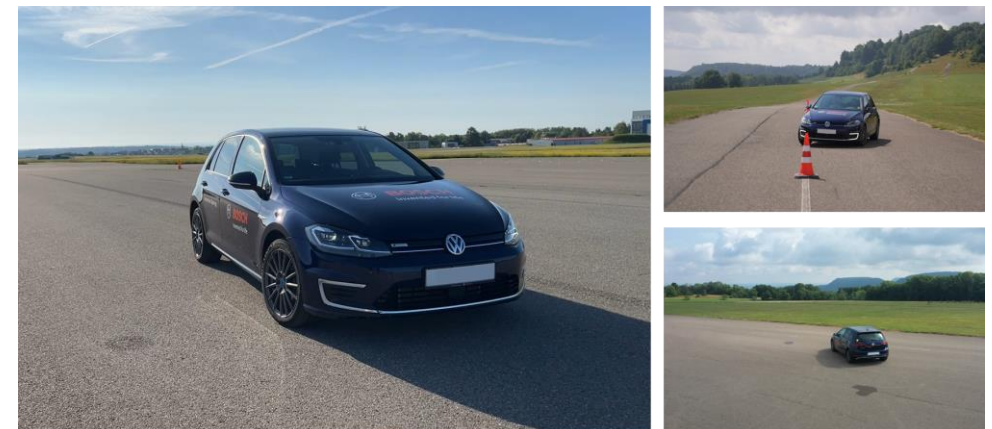
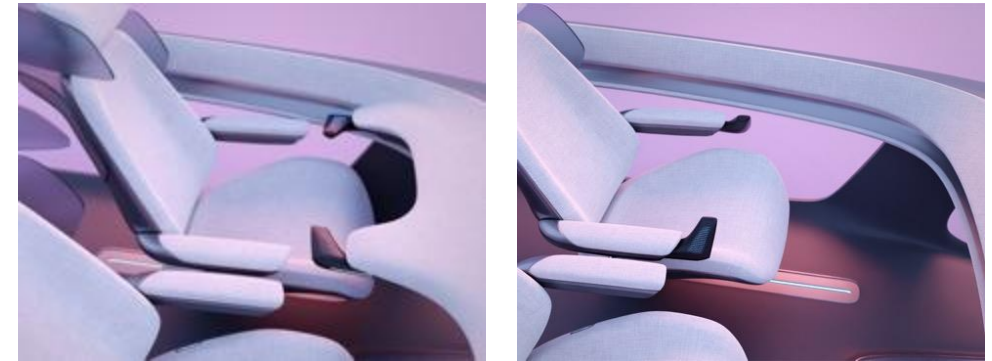


# New Driving Devices

## Positioning

### Where should the device be positioned? How many devices are needed?

- Expert workshop: **Interior concept**
  - Mixed-reality expert workshop (design, ergonomics, steering functions): Positioning of the device
  - Favorite concept: **2 devices** positioned on the **armrests** of the seat
- Driving study: **Single vs. Dual Device** ( $N = 20$ )
  - Two-handed operation (dual device) is preferred over one-handed operation (single device)



# New Driving Devices

## Maneuverability

How is the driving performance with the devices? How do the drivers rate the devices?

- Driving study: **Maneuverability** ( $N = 36$ )
  - The participants can drive as well and as safely with the devices as with the conventional steering wheel and pedals.
  - The concepts can be learned very fast so that the drivers quickly feel confident in using them.



# New Driving Devices

## Conclusion

### Driving feel ★★

- “Steering is very **intuitive**.”
- “I had the feeling that I could **control** the vehicle much better.”
- “After only a few meters you get used to it and can **drive safely and fast** with it.”

### Interior flexibility 💡

- “There is so much **more space** in front of the driver.”
- “**Freedom of movement** because of the available space.”
- “The interior is very neat. It looks **smart and modern**.”
- “Also suitable for the **elderly** and **people with disabilities**.”
- “**Better view** through the windshield.”

### Seating position 🦋

- “**Comfortable position**. The arms rest comfortably on the device.”
- “Seating position is more **variable**.”

### Automated driving 🧠

- “No annoying steering wheel in the automated driving mode.”
- “The instrument cluster allows **more degrees of freedom** for automated driving.”



### Experience 🚀

- “Very innovative.”
- „Extreme driving **enjoyment** (despite the prototypical implementation).“
- “**Super cool realization**, I am totally thrilled!“
- “It was a **great experience!**“
- “I could have **spent days** on it.”



WELCOME

SOUND SHIELD BY



100% 239 km

120 km/h

09:22 17°  
Lufttemperatur

18:00-20:00  
M

13:02 Uhr  
Fahrtzeit

37 km  
bis Ankunft

M

21°C

22°C

Navigation

Media

Climate

Settings

Ready for experiencing the  
next level of driving?



**BOSCH**

Invented for life

e-GOLF



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Vielen Dank für Ihre Aufmerksamkeit



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**CanControls**  
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HOCHSCHULE  
DER MEDIEN