RUMBA

Achieving a positive user experience through user-friendly design of the vehicle interior for automated driving functions

Supported by:

Federal Ministry for Economic Affairs and Climate Action

on the basis of a decision by the German Bundestag

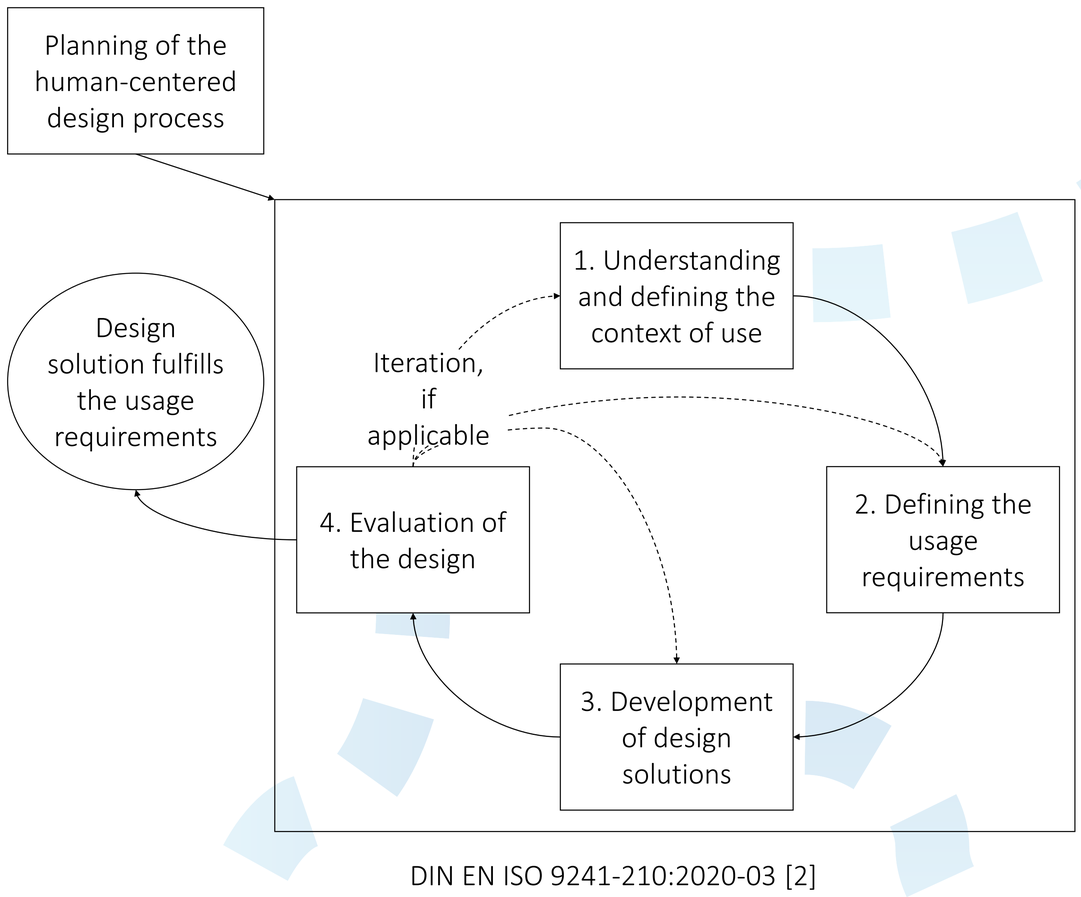
User-centered development in the RUMBA project

Sven Kottmann, Dominique Stimm, Patricia Haar, Michaela Teicht, Anne Pagenkopf, and Arnd Engeln

Hochschule der Medien, Nobelstr. 10, 70569 Stuttgart, Germany
kottmann@hdm-stuttgart.de; engeln@hdm-stuttgart.de

User-centered process

In RUMBA, there is a strong focus on the individual needs of potential users in the context of a drive in SAE Level 4 [1]. A good user experience is to be ensured through the systematic application of iterative, user-centered design processes [2]. This poster shows the first iteration loop in the RUMBA project.



DIN EN ISO 9241-210:2020-03 [2]

1 | Identification of user requirements

Goal:

Identify requirements and needs of car drivers during SAE Level 4 driving.

Approach:

Phase 1 - Driving simulator study (approx. 3 hours):
Behavioral observation while driving in the driving simulator and subsequent interview [3,4]

Phase 2 - Mobility diary (one week):
One week of self-observation during everyday driving

Phase 3 - Post-interview mobility diary (approx. 45 minutes):
Reflection on the diary entries in the context of individual interviews

Result:

Insight into the thoughts and requirements of car drivers [5]

2 | Synthesizing the user requirements

Goal:

Consolidation of the findings of the individual project partners from the empirical user studies of the requirements analysis and identification of design spaces for user-friendly interior design

Approach:

1. Synthesis Workshop
   - Presentation of the results of the empirical studies by the partners
   - Extraction of key learnings by the audience
   - Structuring of key learnings into thematic clusters
   - Formulation of opportunity areas
2. Follow-up of the opportunity areas

Result:

13 opportunity areas:

- Promoting system trust
- Avoid boredom and promote enjoyment
- Present information from the automated system in a transparent way and tailored to user requirements
- Realize safe takeover situations
- Create freedom of movement to facilitate non-driving activities
- Enabling well-being and relaxation
- Making the use of items brought along attractive
- Enabling seating comfort
- Provide information on the route and destination
- Enable cooperative driving
- Optimize alternative control elements for vehicle guidance
- Aim for a balanced driving style adapted to the situation
- Prevent motion sickness

3 | Ideation & low-fidelity-prototyping

Goal:

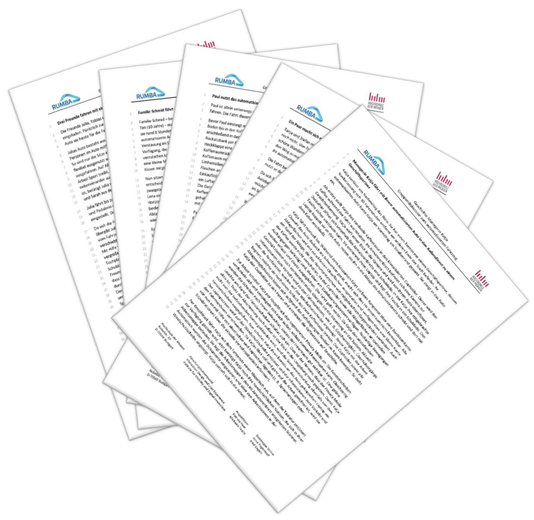
Development of innovative solution concepts for the design of the interior of the vehicle as well as for displays and control elements

Approach:

1. Design Thinking Workshop
   - Brainwriting and brainstorming
   - Open discussion, structuring and prioritization of ideas
   - Low-fidelity prototyping (realizing selected ideas)
2. Development of user narratives

Result:

5 User Narratives



4 | Evaluation of low-fidelity prototype

Goal:

Evaluation and prioritization of early solution concepts and generation of information for further work from the user's perspective

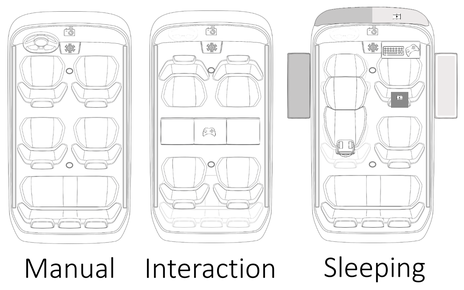
Approach:

Focus group discussions on the user narratives:

1. Open discussion: Unstructured feedback
2. Idea-related discussion: Structuring along the integrated innovation ideas
3. Theory-based discussion: structuring along user experience facets [6], system trust and traffic safety

Result:

Variable interior concept that can adopt three different modes [7]



Manual Driving Mode | Interaction Mode | Sleeping and Individual Occupation Mode

[1] SAE International (2021). *Taxonomy and definitions for terms related to driving automation systems for on-road motor vehicles*. https://www.sae.org/standards/content/j3016_202104/
[2] Deutsches Institut für Normung e. V. (2020). *DIN EN ISO 9241-210:2020-03, Ergonomie der Mensch-System-Interaktion - Teil 210: Menschzentrierte Gestaltung interaktiver Systeme* (ISO 9241-210:2019); Deutsche Fassung EN ISO 9241-210:2019. Beuth. https://doi.org/10.31030/3104744.
[3] Memon, A., Meissner, C. A., & Fraser, J. (2010). The Cognitive Interview: A meta-analytic review and study space analysis of the past 25 years. *Psychology, Public Policy, and Law, 16*(4), 340–372. https://doi.org/10.1037/a0020518.
[4] Flanagan, J. C. (1954). The critical incident technique. *Psychological Bulletin, 51*(4), 327–358. https://doi.org/10.1037/h0061470.
[5] Haar, P., Pagenkopf, A., Teicht, M., & Engeln, A. (2021). Nutzeranforderungen an die Gestaltung von Fahrzeuginnenräumen beim vollautomatisierten Fahren. *Projekt RUMBA*. https://projekt-rumba.de/wp-content/uploads/2021/09/210908_ Nutzeranforderungen-an-die-Gestaltung-von-Fahrzeuginnenraeumen-beim-vollautomatisierten-Fahren-_RUMBA-Website.pdf
[6] Engeln, A., & Engeln, C. (2015). Customer Experience und kundenzentrierte Angebotsentwicklung: Was gehört dazu? In A. Baetzgen (Hrsg.), *Brand Experience: An jedem Touchpoint auf den Punkt begeistern* (S. 253–273). Schäffer-Poeschel.
[7] Teicht, M., Haar, P., Pagenkopf, A., Stimm, D., & Engeln, A. (angenommen zur Online-Veröffentlichung). Evaluation von Innenraumkonzepten vollautomatisiert fahrender Fahrzeuge. *Kolloquium Future Mobility*.

www.projekt-rumba.de