Evaluation of an AR-interface for efficient and safe navigation to DRT pick-up locations

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Background

Research Context

- Automated on-demand ride pooling (AODRP) efficient and safe transportation in the future[1,2]
- Flexible stops with virtual stop-grid as centerpiece for flexibility and convenience[3,4]
- Flexible stops already in use with urban demand responsive transportation service

Virtual stops for AODRP

- No real-world cues for seamless identification and orientation
- Users focused on device may pose a safety risk in traffic environment
- Uncertainty of situation asks for clear and efficient information representation

Aim

Introducing a new concept

Virtual Ride Access Points (VRAP)

- Virtual infrastructure
- Means of Augmented reality
- safe navigation and orientation in urban environment
- decrease uncertainty
- quick identification of the pick-up location and shuttle

Research objective

→ VRAP HMI-Prototype development

→ High degree of pragmatic quality

Method

Research Design

- real life exposure study at DLR Campus in Braunschweig
- Navigation via VRAP HMI-prototype
- Participants not familiar with DLR Campus
- route to pick-up location (approx. 70m) through building and around small corners

Tasks

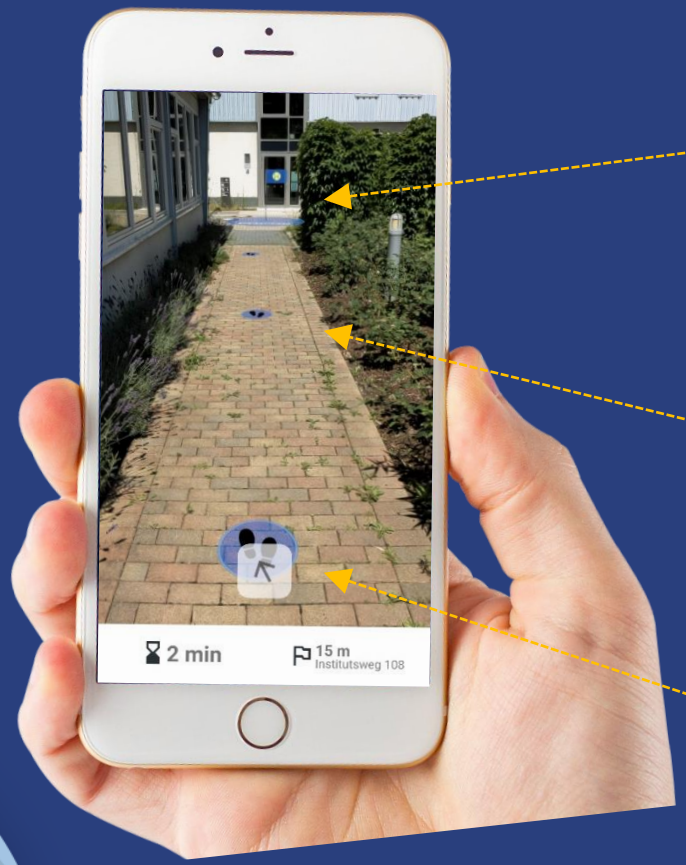
- Initial orientation
- Efficient navigation within given time frame

Dependent Variables

- Evaluation of prototype
- User Experience Questionnaire

Method

Smartphone interface of the VRAP-HMI prototype



AR-information elements

Destination of pick-up location

- Flag pole on the ground
- German stop sign (VZ 224 StVO)
- Round shaped waiting area
- Shows user where to wait for shuttle

Pathway

- Footstep icons on the ground
- Shows user the route to walk

Orientation

- Arrow overlay
- Points towards next Footstep
- Rotates and changes color to red

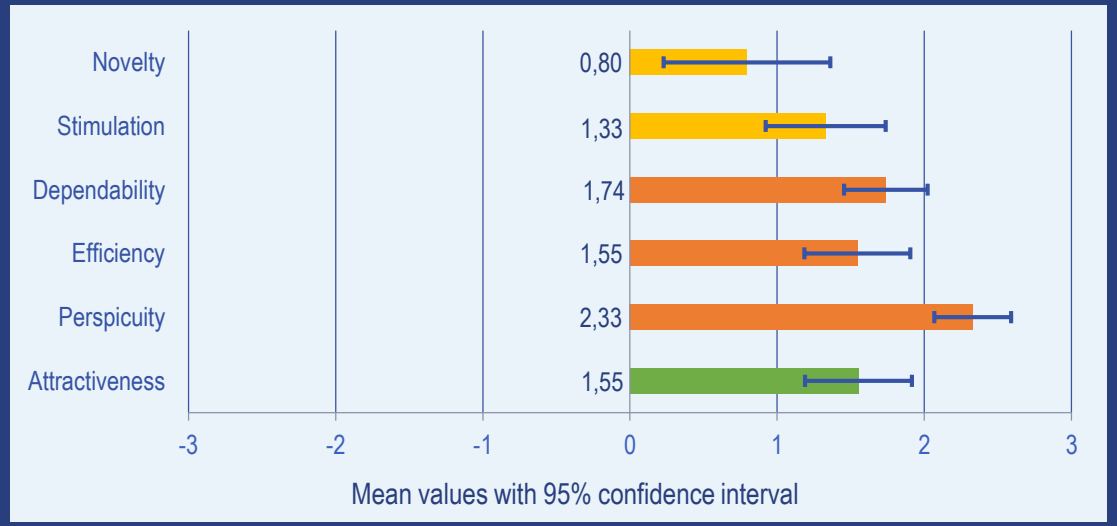
Results

Participants

- N = 23 (61% male)
- Young Adults (Age: M = 24.17; SD = 2.70)
- 96% with smartphone navigation experience (Google Maps)
- 68% at least monthly use of smartphone navigation
- 52% experienced Augmented Reality before
- 78% have never been to the DLR Campus before
- Average technology affinity (M = 2.92; SD = 0.79)

User Experience Questionnaire

- Hedonic quality (M = 1.06; SD = 0.38)
- Pragmatic quality (M = 1.87; SD = 0.41)
- Attractiveness (M = 1.55; SD = 0.87)

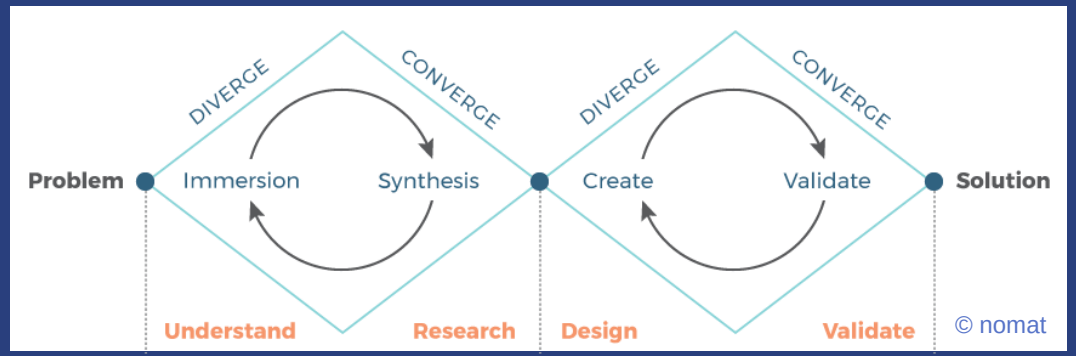


Participants' mean ratings of the UEQ scales

Conclusion

- Results indicate the need for intuitive and efficient information supply
- High pragmatic quality of Prototype → reduced uncertainty in scenario
- Use of AR-interfaces can lead to a safe and joyful experience before boarding the automated shuttle
- highly supportive interface but participants were very focused on smartphone screen
    - New experience / interresting interface?
    - Participants to reliant on AR-interface?

- Further AR-interface development required
- AR experiences will be researched in the context of DRT in future design iterations



Human-centered design process

Thank you very much!

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