CONTEXT-AWARE HMIS IN THE FIELD: EFFECTS ON USABILITY AND USER EXPERIENCE

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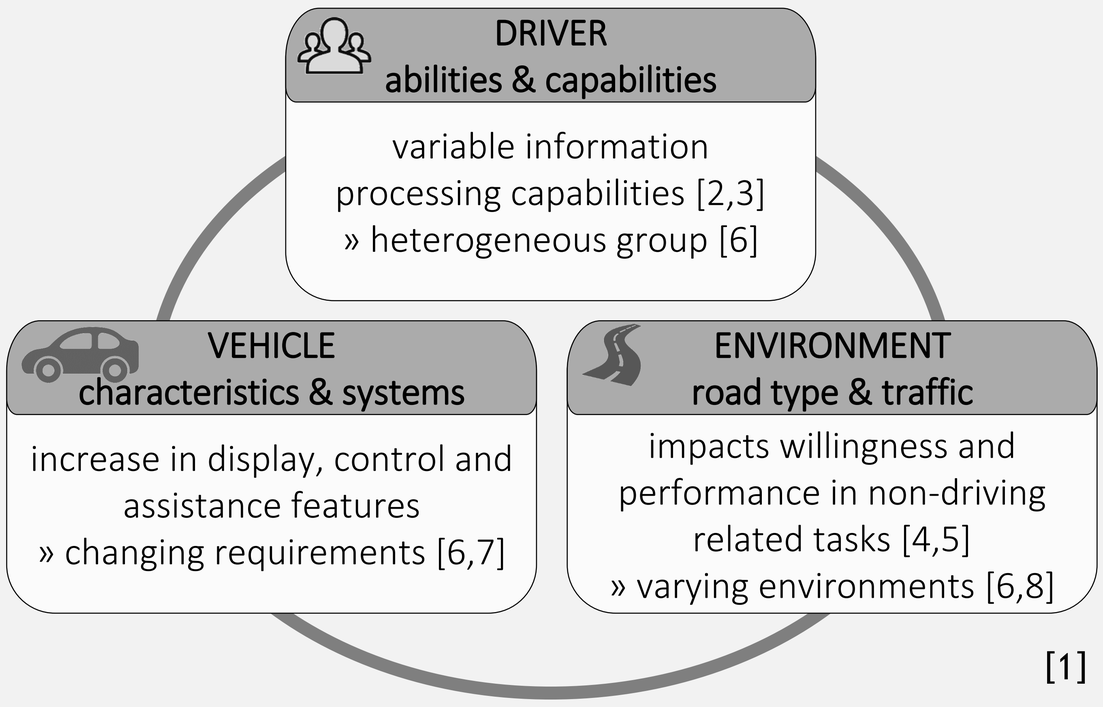
As the increase in displaying space does not necessarily imply further support of the driver, a context-aware adaptation of the content can support the driver's resource allocation. In this field study (*N*=15), two context-aware HMI concepts were evaluated. They were modified based on a previous simulator study (*N*=41) that showed no difference between context-aware and static HMIs in usability and user experience, but a preference for a personally-configured. Here, the HMI adapts in information content and quantity based on the driving scenario complexity. The context-aware HMIs were tested against two static and a personal preference HMI in a five hours test drive. No difference for perceived usability was found, but the context-aware HMIs were rated slightly lower in user experience. Contrary to the previous study, the personal preference did not outperform the other concepts. Hence, context-aware HMIs seem to provide usability and user experience in an automotive context.

INDICATION FOR CONTEXT-AWARENESS



[1]

RESEARCH QUESTIONS

(RQ1) Do context-aware HMIs have a benefit over static HMIs?

(RQ2) Which adaptation strategy is best to use?

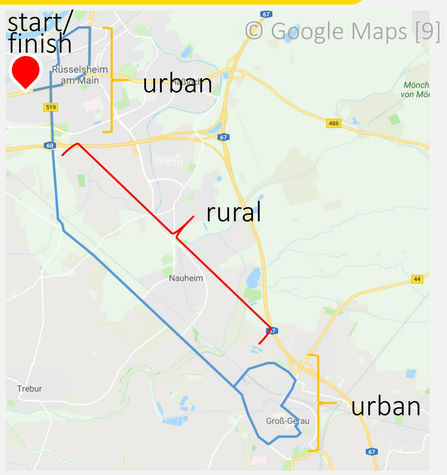
METHOD

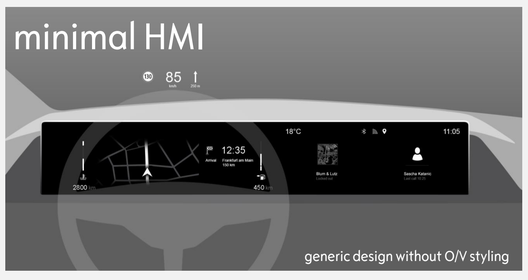
N = 15 (*n* = 8 female),

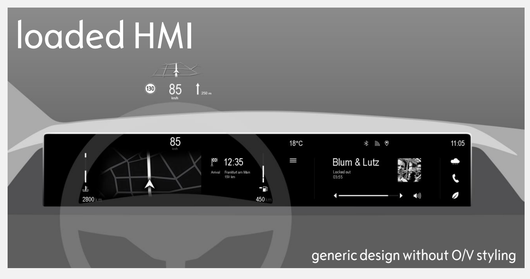
M = 43 years (*SD* = 13; 23-61 years)

»field study (28 km) in an Opel Grandland X with a leading car

»**HMI Design Principle:**
The more relevant the information is for the primary driving task, the closer it is displayed to the central line of sight.





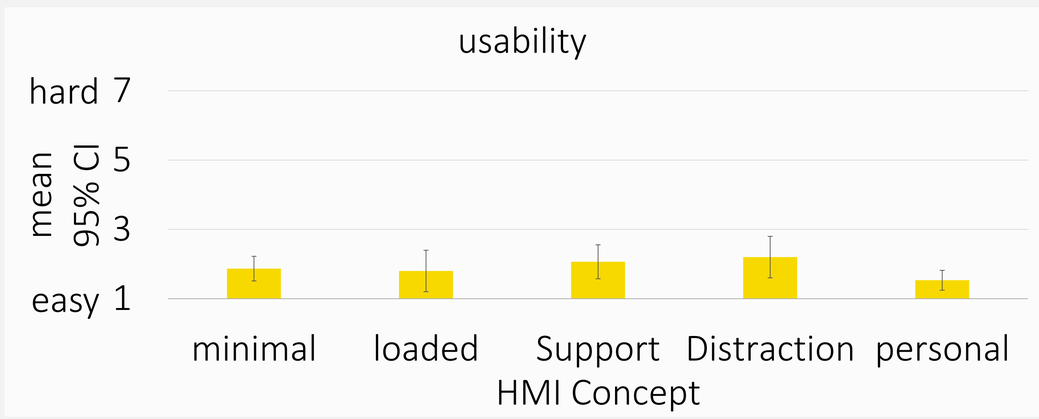


HMI concept		urban: high complexity	rural: low complexity
static	minimal	minimal	minimal
	loaded	loaded	loaded
context-aware	Support	loaded	minimal
	Distraction	minimal	loaded
personal preference		minimal/loaded	minimal/loaded

RESULTS

(1) Usability (System Ease Question [10])

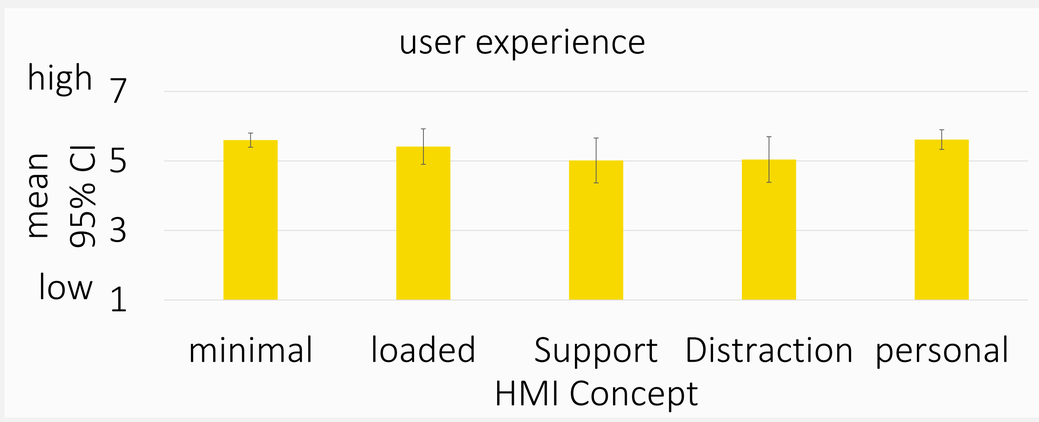
»no significant effect of the HMI concepts, $p = .172$, $\eta_p^2 = .106$



(2) User Experience (User Experience Short Questionnaire [11])

»significant effect of the HMI concepts, $p = .039$, $\eta_p^2 = .163$

»pragmatic quality: minimal > context-aware HMIs, $p < .061$



CONCLUSION & PERSPECTIVE

(RQ1) no impact of context-aware or personal HMIs on usability compared to static HMIs, slightly but not significantly lower user experience ratings for context-aware HMI concepts

(RQ2) no difference in usability and user experience between both adaptation strategies

Context-aware HMIs seem to **provide usability and user experience** in an automotive context and have the potential to **support resource allocation** while providing usability and user experience.

[1] Vollrath, M., & Krems, J. (2011). *Verkehrspsychologie. Ein Lehrbuch für Psychologen, Ingenieure und Informatiker.* Stuttgart: Kohlhammer.
[2] Fuller, R. (2000). The task-capability interface model of the driving process. *Recherche-Transports-Sécurité*, *66*, p. 47-57.
[3] Fuller, R. (2005). Towards a general theory of driver behaviour. *Accident Analysis & Prevention*, *37*, p. 461-472.
[4] Pätzold, A., Zarife, R., Wagner, M. & Krems, J.F. (2018). Digitalisation in the infotainment: User needs and requirements – an explorative approach. In T. Victor, M.P. Bruyas, M. Regan, C. Brusque, A. Fort, and C. Jallais C. *Proceedings of the 6th Driver Distraction and Inattention conference,* p. 29-42.
[5] Pätzold, A., Zarife, R., Wagner, M., & Krems, J. (2019). Effects of driving scenario on subjective workload and secondary task performance. In D. de Waard, K. Brookhuis, D. Coelho, S. Fairclough, D. Manzey, A. Naumann, L. Onnasch, S. Röttger, A. Toffetti, and R. Wiczorek (Eds.) (2019). *Proceedings of the Human Factors and Ergonomics Society Europe Chapter 2018 Annual Conference*, p. 203-217.
[6] Duarte, C. A. (2007). *Design and Evaluation of Adaptive Multimodal Systems* (Doctoral Thesis). Universidade de Lisboa.
[7] Brusilovsky, P.; & Millán, E. (2007). User Models for Adaptive Hypermedia and Adaptive Educational Systems. In: Brusilovsky, P., Kobsa, A. & Nejdl, W. (Eds.): *The Adaptive Web*. Berlin, Heidelberg: Springer, p. 3-53.
[8] Hastie, H. W., Johnston, M., & Ehlen, P. (2002). Context-sensitive help for multimodal dialogue. Proceedings of the Fourth IEEE International Conference on Multimodal Interfaces, p. 93-98.
[9] Google Maps: https://www.google.com/maps/dir/49.9856848,8.4080811/49.9954436,8.4147508/49.9983822,8.4244512/49.9887799,8.4268503/49.9814175,8.4322958/49.9593827,8.4163065/49.9270196,8.4680993/49.9228838,8.4821155/49.9179855,8.4881519/49.9858047,8.4080406/@49.9620172,8.427608,12.52z/data=!4m4!4m3!2m1!1b1!3e0
[10] Sauro, J. & Lewis, J. R. (2012). *Quantifying the User Experience*. Waltham: Morgan Kaufmann.
[11] Schrepp, M., Hinderks, A., & Thomaschewski, J. (2017). Design and Evaluation of a Short Version of the User Experience Questionnaire (UEQ-S). *IJIMAI*, *4*(6), p. 103-108.

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