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Benefits of Usability and User Experience in Automated Driving

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Background

- Usability is an important quality characteristic of software products and systems, information systems, online services, games, etc.
- Good usability can be achieved through user-centered design process, performing usability activities (e.g. usability testing, participatory design, prototyping), and by focusing on usability through the entire development process
- The concept of user experience (UX) has been introduced to take into account the emotions and attitudes of the users
  - *Covering also the expectations, attitudes and intentions to use before and after the actual use of a particular product, systems or service*

Usability Cost-Benefit Analysis

- Usability cost-benefit analysis models outline the potential benefits and costs of usability
  - *Tool for organizations to understand the impact and importance of usability activities and to prioritize them, as well as finding new strategic openings and avoiding risks*
  - *Important when selling the usability activities to organizational management*

- Recently the emphasis has been shifting to the strategic risks of bad usability
  - *A potential method for arguing for strategic usability*
  - *The cost aspect has been omitted recently, as the costs for designing and developing the interface will be realized in any case*

Usability and UX in driver-car interaction and autonomous mobility

- The importance of good usability has been highlighted also in the driver-car interaction
  - *Easy to learn, fast to operate and error-free human-machine interaction (HMI) has been identified as an important requirement for safety, satisfaction and acceptance of new technologies in automotive context*

- Usability and UX have been recognized as important aspects for the wider adoption of automated driving and autonomous mobility
  - *Direct impact on acceptability before the first use and acceptance after the first use*

- However, currently there is a lack of research that addresses explicitly the benefits of usability and UX in automated driving and autonomous mobility context

Benefits of usability and UX in automated driving

- This paper proposes preliminary usability and UX benefits for automated driving applications in organizational context and use context
  - *Addresses autonomous driving applications and HMIs on all SAE driving automation classification levels*
  - *Covers different use cases such as privately owned vehicles, communally shared vehicles, mobility on demand, public transportation, and autonomous delivery vehicles*

- The proposed preliminary benefits are based on
  - *The existing seminal usability cost-benefit and strategic usability literature*
  - *The continuous longitudinal literature review on the usability and UX benefits from different perspectives and in different contexts*
  - *The literature of adapting usability and UX benefits into different contexts, such as open source software development, games and gamification, and on the literature on HMI in driving, automated driving and autonomous mobility contexts*

Usability benefits in automated driving and autonomous mobility context

- Organizational context
  - *Increased sales*
  - *Reduced development costs*
  - *Reduced training and support costs*
  - *Easier and faster acceptance and adoption*
  - *Reduced risk of legal liability*
  - *Conforming to regulations and ethical principles*

- Use context
  - *Reduced errors*
  - *Reduced learning effort*
  - *Increased user satisfaction*
  - *Increased safety*

UX benefits in automated driving and autonomous mobility context

- Organizational context
  - *Increased brand appeal*
- Use context
  - *Increased perceived value*
  - *Increased automated driving and autonomous mobility appeal*

Conclusions

- This paper is one of the first steps on highlighting the strategic role of usability, UX and user-centered design in the development of automated driving, autonomous mobility, driver-car interaction and automotive HMIs
- These results can be used by the practitioners (e.g., managers, usability specialists, and HMI developers) to motivate and justify the usability and UX activities, and the resources needed for them in automotive context
- These results can be used by the researchers to further develop better usability and UX cost-benefit analysis models, theoretical concepts related to driver-car interaction, and the role of usability and UX in acceptability and acceptance of automated driving and autonomous mobility
- These preliminary benefits can be further refined, validated through empirical and experimental testing, and further refined for example to the context of completely autonomous mobility solutions
  - *Interviews, focus groups, nexus analysis, surveys, exploratory case studies, experiments etc.*

Thank you!
Questions, comments?

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