FACULTY OF ENGINEERING AND ARCHITECTURE

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EFFECTS OF HAPTIC FEEDBACK ON USER PERCEPTION AND PERFORMANCE IN INTERACTIVE PROJECTED AUGMENTED REALITY

MOTIVATION & CONTRIBUTION

- Interactive Extended Reality (IXR) applications, such as Projected Augmented Reality (PAR), are gaining attention in multiple facets of society.
- These can be enhanced by means of haptics to create a sensation of touching and manipulating virtual objects
- Research towards the influence of haptic feedback on users' perception and performance is still scarce
- We created a Projected Augmented Reality setup that users can interact with by means of finger-tracking
- Latency was artificially added to study the influence of network degradation
- An experimental user test was performed to evaluate the influence of haptic feedback on user perception and performance

RESEARCH QUESTIONS

Does haptic feedback reduce the duration of a task?

Does haptic feedback reduce the number of errors made?

Does haptic feedback improve user experience?

USER TESTING

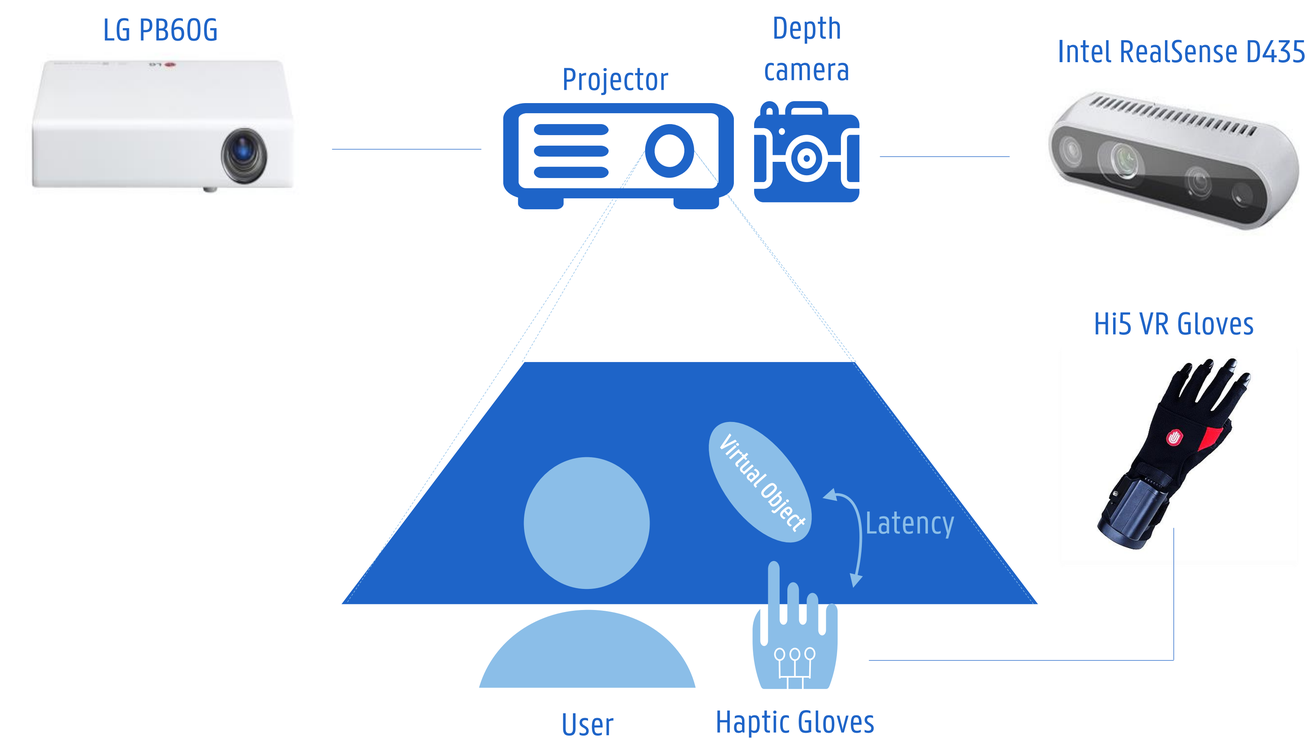
3 different games: Simon Says, Trace The Line and Obstacle Course

23 test subjects: 12 in haptic group (B), 11 in test group (A)

Subjectively evaluated by means of pre-, in- and post-session questionnnaires:
- Age, gender, prior expreience
- Perceived latency
- Expected/perceived influence of haptics on errors and duration

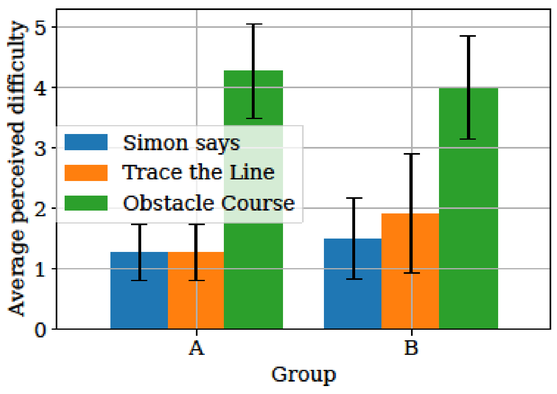
Objectively evaluated in terms of task duration and number of errors

TECHNICAL SETUP

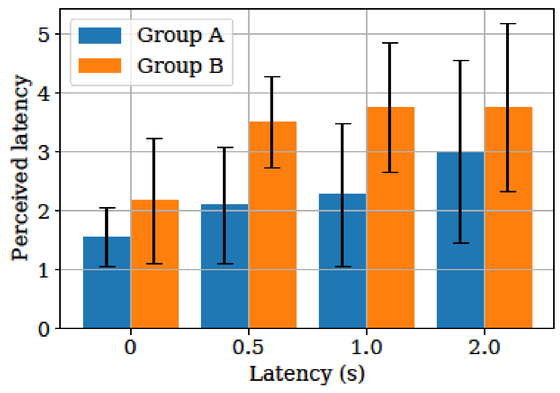


RESULTS

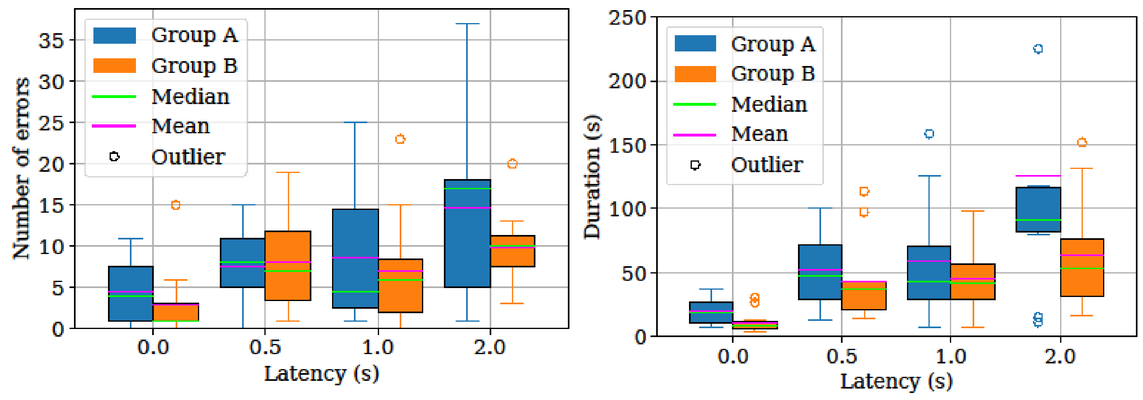
Obstacle course is perceived as more difficult compared to Simon Says and Trace The Line



In the Trace The Line game, the haptic group (B) is consistently perceiving higher latency than the control group (A)



The haptic group (B) is significantly faster and more accurate in the Obstacle Course game when compared to the control group (A). This is not the case for the other games.



CONCLUSIONS

- Haptic feedback reduces execution time and number of errors on tasks perceived as difficult. This effect enhances with increasing latency, but is not reflected in the subjective beliefs.
- For particular tasks, the latency is consistently perceived higher in the haptic group than in the test group
  - ⚠ Addition of haptics may induce increased end-user awareness to reduced network performance
- Future work
  - Larger studies with higher variety of task
  - Inclusion of physiological signals for further perception analysis

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