

Exploring Ease of Use in a Mixed Reality Tabletop Environment



Stockholm
University

Team: Erik Lopez, Hoda Ismail, Leo Nordén, Stella Millwood, Sharad Poudel

Introduction

In this project we are expanding on the concept ease of use in mixed reality (MR). We created an interactive MR prototype by using a tabletop and projection mapping, combining virtual and physical elements. The prototype has three different scenes, each with its corresponding technology including Arduino, image tracking and hand tracking. See Figure 1. Ease of use is defined by level of support and lack of disruptions in interactions with a system. We are expanding on this concept by applying it in MR and using a qualitative approach.

Research Question: How can interactive mixed reality tabletop experiences be applied to enable ease of use?

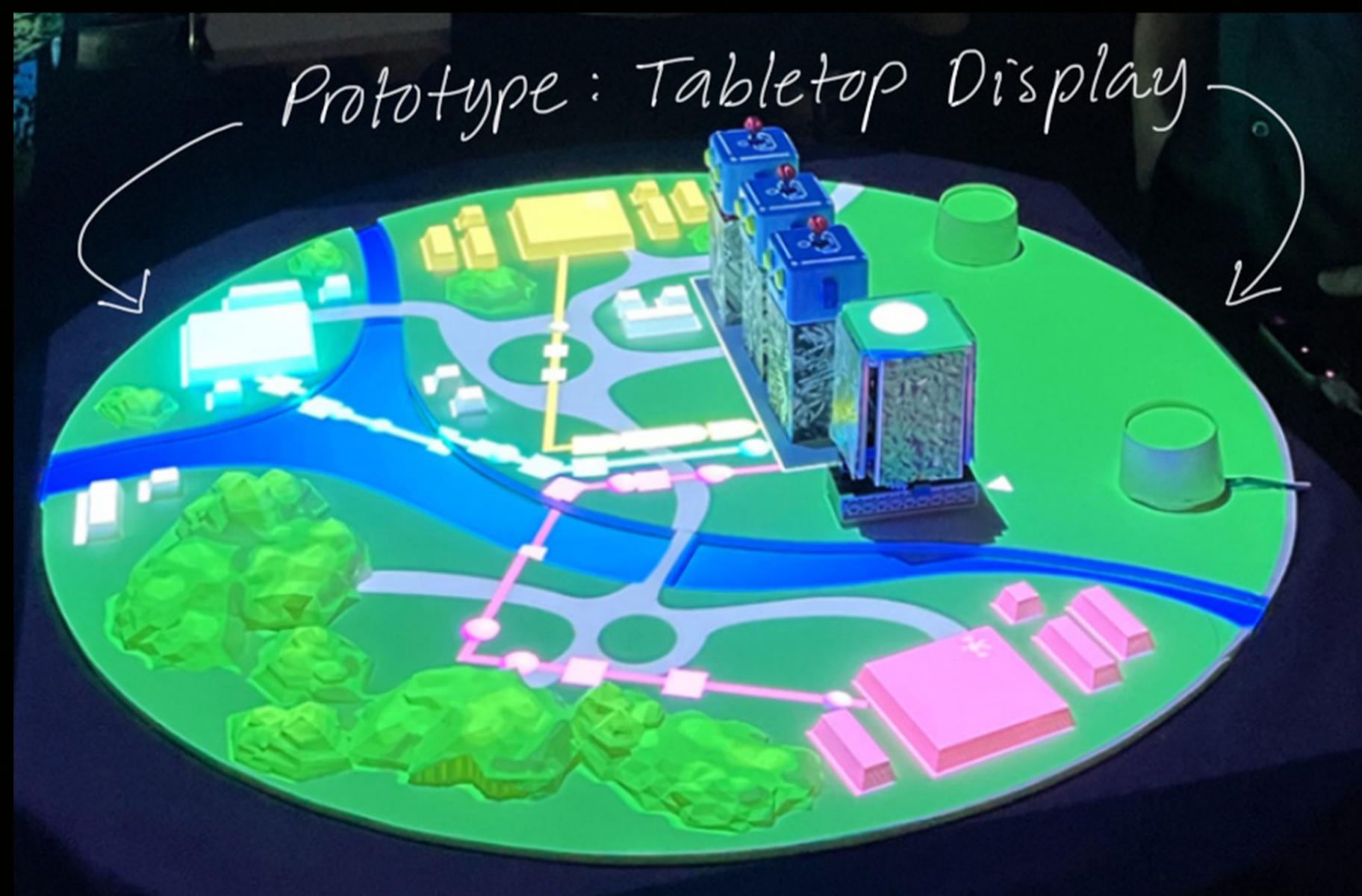


Figure 1: The prototype showing the image tracking setup.

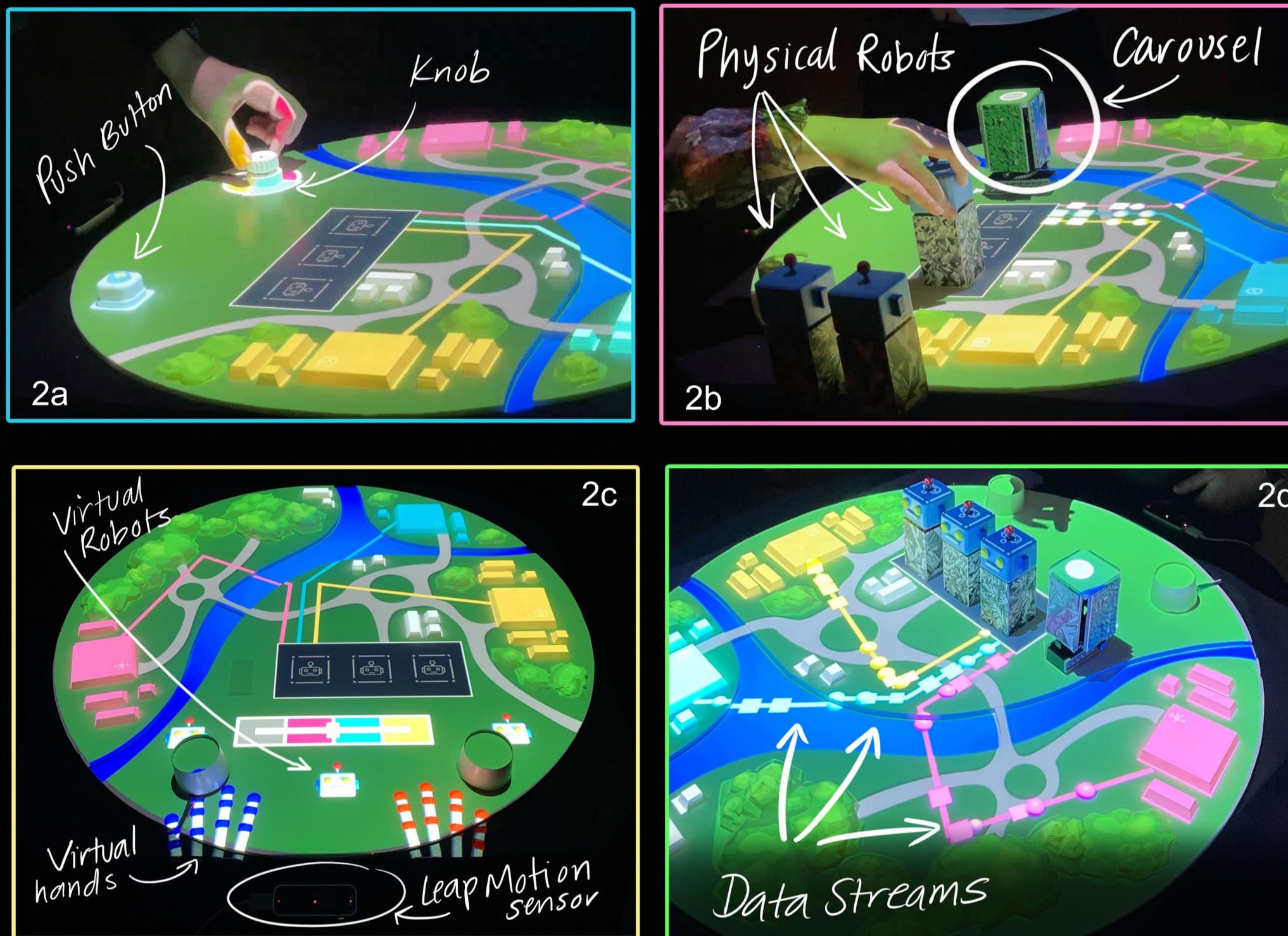
Methods

- Research through Design (RtD) as research strategy
- Quota Sampling

Data Collection	Purpose	Data Analysis
Pre-task questionnaire	Map out participants' skills and demographics	Descriptive statistics
Observations	Observe participants' interactions with prototype	Thematic analysis (complement to interview analysis)
Semi-structured interviews	Follow up on observations, focus on ease of use	Thematic analysis

Prototype

To help us answer this question, we created an interactive tabletop display which included: a table, a small 3D model of a city landscape, a computer, a few other electronic devices, and a projector mounted on the ceiling for projection mapping. See figures 2a, b, c and d.



Figures 2a, 2b, and 2c show the different scenes of the prototype and 2d the data streams.

Results and Analysis

- Pre-task Questionnaire: A few had previous experience with MR
- Design Suggestions: Focus on hand tracking and the carousel in image tracking
- Themes:

Theme:	What it is about:
Feedback and its Effects	Good and bad feedback, need for multisensory feedback, handling problems
Perceptions of Immersive Technologies	Excitement and curiosity, what "fits" with MR
The Process of Learning	Expectations versus reality, how to learn interactions and complete tasks
Following one's Intuition	Positive/negative outcomes, consequences
Mental Models	Associations for design elements and prototype as whole

Discussion

Three different perspectives on ease of use:

- What standards exist and what don't
 - Standards exist for the virtual and physical elements separately, but not in combination
- What issues are specific to immersive technologies
 - Casting shadows, physical artifacts limiting the field of view and the choice of physical artifacts
- How ease of use is affected by previous experience and knowledge
 - Associations and Mental models

Conclusions

Our findings suggest that ease of use in MR tabletop experiences can be enabled by:

- Providing users with guidance on how to interact with the system with a focus on hand tracking specifically
- Provide multisensory feedback to users, especially in tasks that require high precision
- If possible, using simple designs such as buttons and knobs for critical interactions
- Using commonly known 3D objects for interactions that match reality

References

- [1] Jain, S., Schweiss, T., Bender, S., & Werth, D. (2021). Omnichannel Retail Customer Experience with Mixed-Reality Shopping Assistant Systems. In *International Symposium on Visual Computing*. Cham: Springer, pp. 504-517.
- [2] Rokhsaritalemi, S., Sadeghi-Niaraki, A., & Choi, S. (2020). A review on mixed reality: Current trends, challenges and prospects. *Applied Sciences*, 10(2), pp. 1-26.
- [3] Roy, M., Romit, D. N., Chunduru, V., Chittawadigi, R. G., & Saha, S. K. (2021). Interactive image projective desktop and screen using hand tracking by leap motion. In *2021 IEEE 9th Region 10 Humanitarian Technology Conference (R10-HTC)*, pp. 1-6.