Designing a Virtual Reality Interface to Engage Users for Solving a Rubik's Cube on a Digital Platform

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Background

- The mixed reality (MR) spectrum (Fig. 1) offers a unique opportunity to use **immersive experiences as a teaching medium** that is more engaging and aids the retention of information.[2]
- In this study, we designed a **digital 3D Rubik's Cube platform called ALLURE** (Fig. 2) to create an enticing and educational adaptive learning system that can be implemented in K-12 schools.

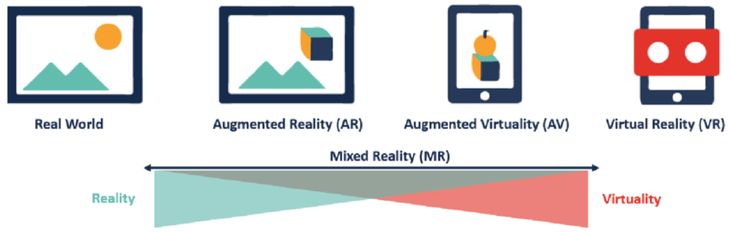

Fig 1. The mixed reality spectrum[1]

Introduction and Current Observations

- MR should take inspiration from responsive web design while **using its 3D nature to its advantage**, as some information lends itself to be better represented in 3D, like a Rubik's Cube.[3]
- One common response from users with the current mouse-driven interaction on the ALLURE platform is that they **missed the tactile aspect of a physical Rubik's Cube** and were unable to rely on muscle memory to solve it. Thus, there is a need for a kinesthetic version of the platform, such as a touchscreen for tablets or a VR/AR implementation.[2]
- This research **explores Unity's capabilities as a real-time VR development engine** and the possibility of implementing the ALLURE platform in VR.[4]
- **To ease the transition between PC and mobile devices**, several UI changes will need to be implemented to provide a more seamless, touch-capable user interface.[5]

VR Introduction

- **Unity**: Unity offers a robust and simple VR workspace to develop many types of experiences that are compatible with most headsets.[6]
- **VR Field:** Some common categories for VR development are games, education, physical and mental health, productivity and collaboration, design, social, and professional training.[4]
- **Limitations:** VR development is limited both by the amount of people who do not have access to a VR headset and by physical body limitations of the user, such as cybersickness.[7]

ALLURE in VR

- **Integrating VR into educational experiences makes learning more fun and increases motivation**[2]
  - VR provides immersive experiences that cannot typically happen in a classroom.
  - Interacting with 3D models increases comprehension.
- **Oculus Quest already has a Rubik's Cube VR app called *Speed Cube***[8]
  - Out of 12 ratings, the app only has 2.5 stars with 33% of users rating it at 1 star.
  - Many bad ratings state that it was difficult to turn the cube and that the app overall was not worth it.

ALLURE Platform

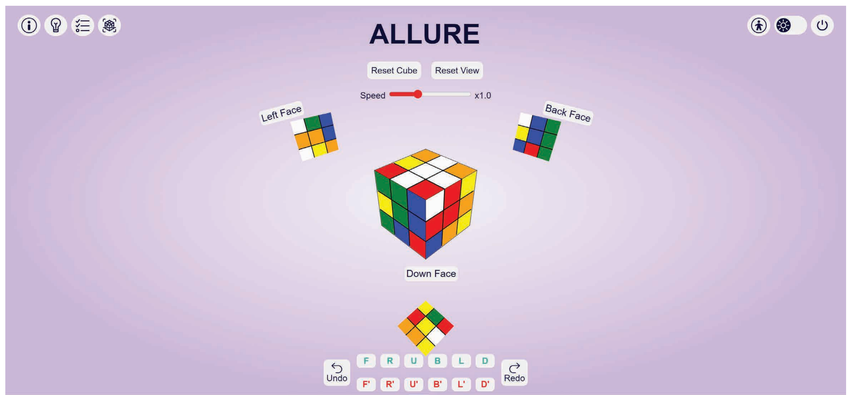

Fig 2. The ALLURE platform equipped for touchscreen and multiple displays

ALLURE UI Design Changes

- To improve clarity, we **reconfigured the buttons on the ALLURE platform (Fig. 2)** around the screen, based on user feedback. The buttons were also made larger, and any text was replaced with icons.
- We created a **low fidelity prototype** for the tablet version of the platform and have started implementing it in code.

ALLURE Next Steps

The ALLURE platform will benefit more from focusing on its UI design and other novel features.

- **Touch screen** capabilities and tactile features can possibly make the ALLURE platform feel more representative of a physical Rubik's Cube.[2]
- **Chatbot** functionality will be improved to be more assistive and be modified to allow for tablet and mobile users to talk with it without a keyboard.
- **Gamification** strategies, such as implementing an achievement system and leaderboard, will provide more motivation and enjoyment to users.[9]
- **The Scanning Cube** feature will allow users to work with a physical Rubik's Cube alongside the platform, allowing more flexibility in how they use the platform.

Acknowledgements/References

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References will be available upon request.

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