

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

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## Background

- 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.
- 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.<sup>[2]</sup>

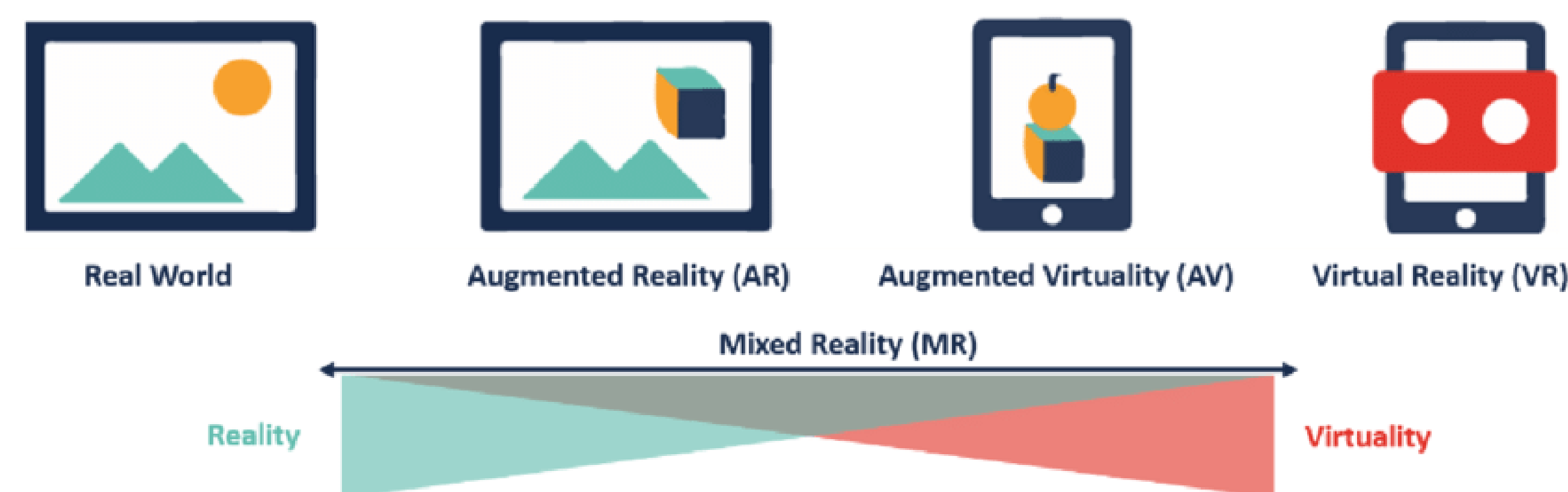


Fig 1. The mixed reality spectrum<sup>[1]</sup>

## Introduction and Current Observations

- Mixed reality 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.<sup>[3]</sup>
- 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.<sup>[2]</sup>
- This research **explores Unity's capabilities as a real-time VR development engine** and the possibility of implementing the ALLURE platform in VR.<sup>[4]</sup>
- 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.<sup>[5]</sup>

## VR Introduction

- **Unity:** Unity offers a robust and simple VR workspace to develop many types of experiences that are compatible with most headsets.<sup>[6]</sup>
- **VR Field:** Some common categories for VR development are games, education, physical and mental health, productivity and collaboration, design, social, and professional training.<sup>[4]</sup>
- **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.<sup>[7]</sup>

## ALLURE in VR

- **Integrating VR into educational experiences makes learning more fun and increases motivation**<sup>[2]</sup>
  - 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**<sup>[8]</sup>
  - 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.

## Redesigned ALLURE Platform



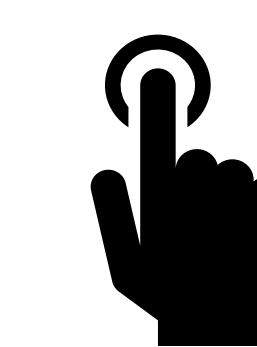
Fig 2. The redesigned ALLURE platform equipped for touchscreen and multiple displays

## ALLURE UI Design Changes

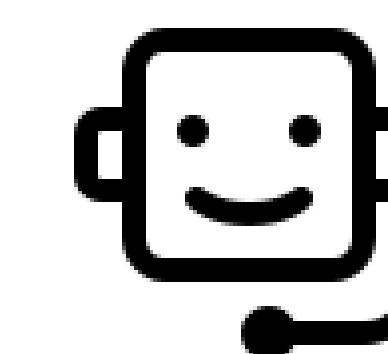
- To improve clarity, we **reconfigured the buttons on the ALLURE platform (Fig. 2)** around the screen, based on user feedback. The buttons were also made larger, and any text was replaced with icons.
- We created a **low fidelity prototype** for the tablet version of the platform and have started implementing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

## ALLURE Next Steps

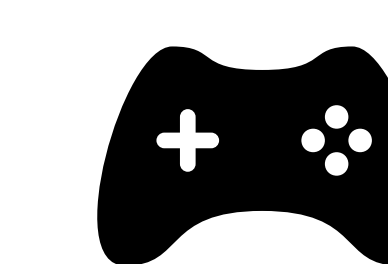
The ALLURE platform will benefit more from focusing on its UI design and other novel features.



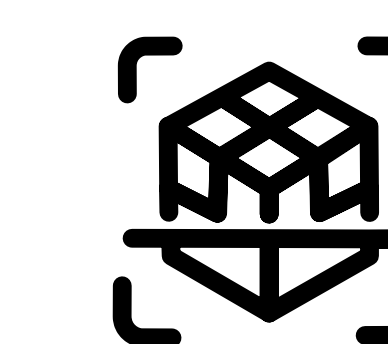
- **Touch screen** capabilities and tactile features can possibly make the ALLURE platform feel more representative of a physical Rubik's Cube.<sup>[2]</sup>



- **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.<sup>[9]</sup>



- **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.