ABSTRACT
In our laboratory, we are dedicated to harnessing the power of Virtual Reality (VR) games to improve and assess memory function across various age groups, including both young individuals and the elderly coping with conditions like Alzheimer's and dementia, as well as those simply seeking memory enhancement. Our approach involves using the Oculus Quest 2 VR headset operating on Android 10, in conjunction with the Unity game engine, to develop these programs. Our memory-enhancing games encompass assessments of spatial, episodic, and auditory memory, incorporating tasks like the Corsi Block-Tapping Test, memorization exercises, and auditory puzzles. These games include modified versions of traditional favorites such as "Simon," memory card challenges, and even simulated shopping experiences. [1-3]

Introduction
We're creating special VR games to help people boost their memory skills. These games are made specifically for seniors dealing with Alzheimer's, dementia, or anyone who wants to improve their memory. Plus, our VR games can help anyone relax by immersing them in peaceful virtual worlds. VR's interactive nature keeps players interested and motivated to join in therapy. This not only helps patients but also eases the burden on healthcare workers and caregivers, while giving patients more independence and confidence. [1-3]

Method
In our lab, we're working on making virtual reality games that help people. We use the Oculus Quest 2, a VR device that works well and is easy to use. It has clear screens and can track movements accurately, making you feel like you're really in the game. To control the games, we use special controllers called Oculus Touch. They're designed to be easy to use and have sensors to track your hand movements accurately. To make the games, we use a software called Unity, which is great for creating VR experiences. It's easy to use, so we can design fun and}

interactive worlds that suit the needs of our players. We also use Blender, another software, to make our games look amazing with graphics and animations. Our goal is to use these technologies to create fun and helpful games that motivate people to recover faster and feel better both physically and mentally. [4-5]

Corsi test with VR
We've worked hard to create memory assessment tools that are engaging and cover different aspects of memory. We've developed three types of tests to measure different memory skills and give valuable insights into cognitive abilities.

The first test is the Corsi Block-Tapping Test, which checks spatial memory. Participants watch a sequence of blocks being tapped in a certain order and then try to repeat the pattern. This shows how well they can remember where things are in space. [6]
rooms aim to simulate the distinctive characteristics typically found in girls' and boys' rooms, especially during childhood. Implementing the test in a virtual reality environment proves beneficial for children who may feel shy or uncomfortable when instructed by a complete stranger on how to interact with the cubes. Furthermore, the constant presence of a test administrator sitting opposite the child can create a sense of scrutiny, increasing performance pressure and potentially inducing stress.

Figure 3 – Girl and boy room model

The second test is a memorization test set in a virtual shopping trip. It checks episodic memory, which is about recalling specific events. Participants go through a shopping scenario, pick items, and later recall what they bought and other details. This test makes memory assessment feel like real life. The third test focuses on auditory memory, which is important for remembering what we hear. Participants listen to words or phrases, do other activities, and then try to remember the words they heard. This helps us understand how well they can recall auditory information. Our tests are designed to be easy to use and enjoyable for people of all ages, including older adults and those with cognitive issues. We believe in the importance of thorough memory evaluation for various purposes like cognitive rehabilitation and detecting memory problems early. By using virtual reality, we're making memory assessment more fun and accurate. We're committed to advancing memory research and helping individuals understand their memory better, leading to better interventions and future improvements in memory assessment and cognitive abilities.

Memory improvement games

In our virtual reality innovation, we've developed three memory games. Each game is carefully designed to focus on different parts of memory, making them fun and effective for users. The first game is "Simon," a classic memory game revamped for VR. Players see four colorful objects that make sounds when touched. The game lights up buttons in a sequence, and players have to repeat it. As they advance, the sequences get longer, challenging their short-term memory and giving them a rewarding experience. The second game is a VR version of the classic memory card game. Players flip cards to find matching pairs while remembering where they've seen cards before. With more cards and difficulty levels as they progress, it's a fun way to improve spatial memory and recall skills. Lastly, we have a shopping simulation game that's both innovative and engaging. Players navigate a virtual store, picking items from a shopping list within a time limit. This game tests episodic memory as players remember what they need while moving through the store. By blending memory training with a real-life scenario, this game makes memory practice more relatable and useful.

Figure 4 – Screenshot during the shopping simulation

Conclusion

We specialize in developing serious games based on virtual reality. Our primary tool is the Oculus Quest 2 virtual device. To create our software, we rely on the Unity game engine. Our main focus is on memory-testing tools and games designed to enhance memory. These games involve various memory assessment tests covering spatial, episodic, and auditory memory. Examples of our memory games include "Simon," a card matching game, and a shopping simulation.

KEYWORDS

virtual reality, memory improvement, memory test, serious games, development

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