

# A Multi-User Collaborative Game Created to Improve Cognitive and Physical Aspects and Socialization Skills of Individuals with Dementia

Austin Lu, Jing Fan, Nilanjan Sarkar

Department of Mechanical Engineering, Vanderbilt University, Nashville, TN

KEYWORDS. Dementia, Razer Hydra, Unity.

BRIEFS. A multi-user collaborative game was created to improve the socialization skills and cognitive aspects of individuals with dementia.

**ABSTRACT.** Dementia is a disorder of the mental process which is typically caused by brain disease, brain injury, or aging. Dementia is tough for both the individual with dementia and the family due to the dementia symptoms and the cost of treatment. Some symptoms include memory loss and loss in communication skills. The medical bills for individuals with dementia tend to be very high. Costs for treatment for individuals with dementia over a long-term period is very expensive. Additionally, treatments can be uncomfortable and dangerous [e.g. surgery]. The goal of the current research was to create a new form of treatment that is more effective, engaging, and affordable for patients. A multi-user 2-dimensional collaborative game was created through Unity, a cross-platform game engine, that requires two individuals to communicate with each other to meet the game objectives [match ten images correctly]. Currently, the game is fully functional and is intended to be tested on individuals with dementia to figure out how effective and engaging the game is. Ultimately, the goal of the game is to improve the individual's socialization skills so they can effectively and efficiently communicate with someone.

## INTRODUCTION.

Approximately 46.8 million individuals have dementia; this number is estimated to increase to 131.5 million individuals in 2050 [1]. Roughly 5.5 million of the individuals currently suffering from dementia live in the United States [2]. Dementia is a disorder of the mental process of an individual that can be a result of old age, brain injury, or brain disease. Individuals who have dementia typically have memory disorders, personality changes, and impaired reasoning. Among older adults suffering from dementia, roughly 70% develop significant disabilities. 35% of the 70% will end up living in a nursing home [3]. There is currently no cure for dementia, and the various types of treatments available to these individuals (e.g. medicines, surgery, and psychological therapy) are extremely expensive [3]. Consequently, many doctors and patients seek more effective, appealing, and cost-reduced forms of treatment.

Video games and virtual reality are currently popular, allowing researchers to use it as a platform. A virtual environment is a three-dimensional representation of a setting in which the user perceives themselves to be conducting the actions in the virtual environment. Virtual environments are also being used for patients with strokes in hopes that it will improve their conditions [2].

In this study, a multi-user game was created to improve long-term function abilities and socialization skills for individuals suffering from dementia. Other research conducted has been tested on individuals with dementia through the use of a video-sports game [5]. Like the video-sports game, the multi-user game created here also focuses on the individual's socialization skills and cognitive functions, but the game created here does not use a sport game specifically created for rehabilitation [5]. The treatment created improvement in the functionality of the dementia patients. We focused on multi-user interactions because fostering social

interactions of individuals with dementia is pivotal to their ability to live as close to a normal life as they once had.

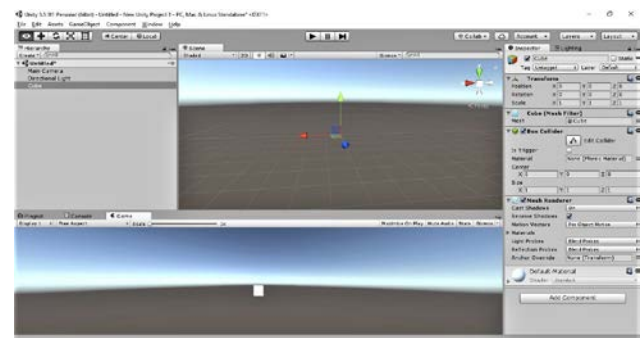
## MATERIALS AND METHODS.

### Unity Software.

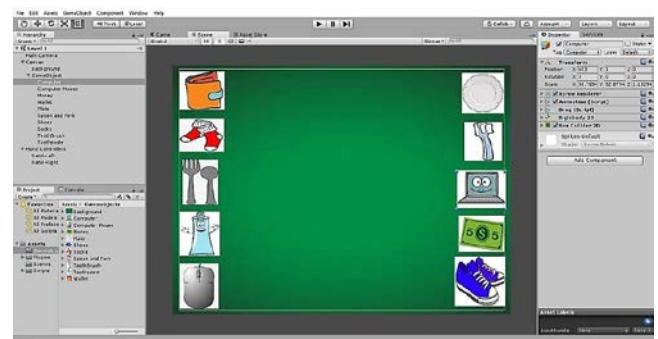
The multi-user 2D interactive game was created using Unity, a cross-platform game engine that allows individuals to create games [6]. Unity can be used to create games for major consoles such as Xbox™, PlayStation™, PC, and Virtual Reality (VR). Many individuals use Unity because the gaming program comes with a website and program that is very user-friendly due to the large variety and easy accessibility of tutorials and examples. The layout of the Unity program can be seen in Figure 1.

### Images and Script.

Ten images were imported into Unity, five on the left side and five on the right side of the screen. Each image on the left side matches with one on the right side. For example, an image of a toothbrush would be on the right side, and an image of toothpaste would be on the left side, which can be seen in Figure 2.



**Figure 1.** Image of the layout of the program called Unity. This is where the user can alter the location and movement of objects. Game objects can also be created and implemented in the terrain created based on the user's preferences. Files and scripts can be saved and access from here as well.



**Figure 2.** Image of the ten game objects that are required to match correctly. The five game objects on the left side are paired with five game objects on the right side.

Once the images were implemented into the terrain, the background and images were separated into layers. The background was set as the base layer and the images were set as layer one so that the images would be seen. In order for each image to be moved, a drag script was created and implemented as a component. This script was written in C Sharp and allowed the controller to move the image around on the game screen. A Rigidbody2D and BoxCollider2D component were also attached to each image, preventing the images from colliding with each other. A name tag was created and assigned to each image. This allowed the individual to know which image he or she has chosen and it allows the script to determine whether or not the pair is matched correctly.

#### Gameplay.

To control these ten images in the game, a Razer Hydra will be used. A Razer Hydra is a wireless motion sensor with two controllers. The Razer Hydra is used to drag the game object to the center of the screen. The two players will each use one of the controllers that are connected to one computer. The left controller controls the five images on the left side and the right controller controls the five images on the right side of the game screen. The two participants have to communicate with each other in order to correctly match the images.

#### RESULTS.

The multi-user 2-dimensional collaborative game is fully functional. The users participating in the game are able to control the images with the Razer Hydra. The game is able to determine when two images are paired correctly. When this is determined, the individuals acquire a point. When two images are paired together incorrectly, no points are awarded and the images will disappear. Since individuals with dementia tend to have impaired reasoning and memory loss, a tag successfully appears each time the controller is over each image. This tag will hopefully help the individual in pairing the ten images correctly. The images can be dragged by each controller in the game since the drag script is fully functional. After each game, the images can go back to their original positions so that the game can be replayed or restarted.

#### DISCUSSION.

Dementia is a common disease among older individuals [1]. Although scientists and doctors are attempting to find a cure, there are some treatments that are currently available. Since these treatments are required to be used for a long period of time, individuals suffering from dementia tend to have to spend a large amount of money which often times can be painful treatment. As technology is increasingly popular in today's society, scientists have attempted to use games as well as interactive toys as a more modern and engaging form of treatment [4, 7]. Many of these forms of treatment are for one individual and used to improve physical functions for the individual [5]. Since many of the games that are currently tested as a form of treatment are focused on the physical aspect of the individual suffering from dementia, the game that was created in this research focused on the cognitive aspect and communication skills. In the future, different levels of difficulties in this game could be used to also improve socialization skills. The more difficult the game is, the more the two individuals have to communicate with each other to achieve the common goal of matching the images correctly. A form of feedback

can be used, such as a survey, to determine how easy it is to control the game, if the game was enjoyable, and how useful the game was to the individuals participating in the research. The individuals chosen to participate in the research can be divided into different groups. One group could be composed of individuals with early stage dementia, another group of individuals who have a later stage of dementia, and a third group that would be a mix between individuals with late and early stage dementia. With these groups, it can be determined how effective the game is for each stage of dementia and figure out ways to improve the game so that the game could be used as a potential form of affordable treatment. Other methods of collecting data can also be used to further create a game that is more efficient and effective, such as recording the individuals while they play the game so we can understand and analyze what the individuals were doing and what they were not doing.

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Austin Lu is a student at Martin Luther King Jr. Magnet School in Nashville, Tennessee; he participated in the School for Science and Math at Vanderbilt.