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[Neuro]-therapy: Alternative Intervention for Memory Disorder

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Abstract: Concerns on finding appropriate and the most efficient way of treating elderly suffering with memory disorder diseases like Dementia and Alzheimer have been a growing issue of discussions over a decade. Current pharmacological treatment is expensive and has its drug side effects. Therefore, alternative solutions are needed in giving harmless and more leisure treatment to the patients. Throughout the past years, various researchers and scientists have come up with various alternative treatments, including the ones in helping to simulate the brain and one of them is by using games. Although various games have been created for elderly, not all games are suitable to be used in memory treatment. Most of the games were not developed specifically for memory disorder patients. They are not created to suit these audiences because there are no known guidelines to help in creating a proper game. This project introduced [Neuro]-therapy, a game designed and developed based on specific criteria which comprises of 20 criteria of psychotherapy-intervention for memory disorder patients. The criteria are categorized into four main categories; gameplay, device, interface and game features. The game is available in Android environment and has been successfully evaluated through both verification and validation involving 55 respondents among elderly. Findings show that the proposed [Neuro]-therapy game is usable among elderly for psychotherapy purposes. Series of psychotherapy experiments have been conducted during the period of Movement Control Order (MCO). [Neuro]-therapy has become an alternative to elderly who are restricted from outside world during MCO. The game is proven to give benefits to many parties; the

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scholars, practitioners, caretakers, and patients. It is hope that it will give directions to developers on developing more games for memory disorder patients towards improving the quality of life among the elderly with memory disorder issues.

Keywords: Elderly, Game-Based Intervention, Game-Based Psychotherapy, Memory Disorder

1. Introduction

Cognitive impairment (or memory disorder) is a brain condition that causess a gradual loss of memory, reasoning, and cognitive capabilities [1]. It raises problems with cognition, memory, decision-making, and communication. This condition is caused by a variety of reasons such as age, trauma, tumours, and even vitamin shortages [2, 3].

Multiple studies have recently demonstrated that games can help people with memory disorders. To work and regain memory, psychotherapy through games necessitates mental attention, memory, and rapid motor reaction in a simulated brain [4, 5]. Serious games may also be beneficial to persons suffering from Alzheimer's disease, which is one of the most difficult conditions to overcome. With an ageing population, healthcare systems must adapt [6]. Non-pharmacological therapy games, often known as serious games, teach people ordinary everyday tasks such as cooking and housework in order to train and replicate their memory [7].

Mobile psychotherapy games have been widely used in the context of elderly in order to improve their cognitive functions and have emerged to be a promising tool for memory disorder [8]. A study conducted by [9] introduced a memory game in remembering the position of the blocks and to guess the which block shows the same item. However, there are only nine blocks provided and this game do not provide any challenge with different level of difficulties. Another serious game is introduced in 3-Dimension by employing activities daily life (ADLs) concept [10]. This concept is also been integrated by [11] in their 3-Dimensional games. Nevertheless, the concept of ADL is hard for the elderly to follow since the designs of these games are based on complex navigation.

A mobile application is also introduced by [12] integrated with 4 different games, Cubbie, Colorie, UnlockIt and Concentration game however these games are tailor-made for concentration training where there is no element for improving memory disorder been found. Besides, there is no rewards provided in the games [12], when there is no goal in the task, it is hard to engage them in the games [13, 14]. [15] has introduced a tactical-based game name Lily's Garden where the users have to complete the task within numbers of move given. However, this feature will demotivate users as it is suggested not to include losing element in the game for elderly [16]. In addition, the colour used in the interface of Lily's Garden game are too bright and colorful that will distract the elderly as well as cause uncomfortability [16].

The introduced psychotherapy games show drawbacks in satisfying the criteria for elderly. They are not tailored to the requirement for elderly. It is necessary to design and develop a suitable mobile game with features that satisfy the requirement to be used by elderly as well as able to help in boosting their memory function. Therefore, [Neuro]-Therapy is proposed and designed specifically for elderly people with memory disorder. The game has become an alternative to elderly who are coincidentally impacted with Movement Control Order (MCO) which have restricted them from other risky activities.

2. Materials and Methods

25 criteria for psychotherapy games were identified using a combination of interviews and a rigorous literature research. Three sets of psychotherapy game criteria have resulted from these initiatives. These three sets of criteria have been investigated, contrasted, and examined extensively.

Duplicates have been eliminated. The criteria have been categorized into four main categories; device, game interface, game features, and gameplay. Figure 1 shows a guideline of psychotherapy games which comprises of four main categories.

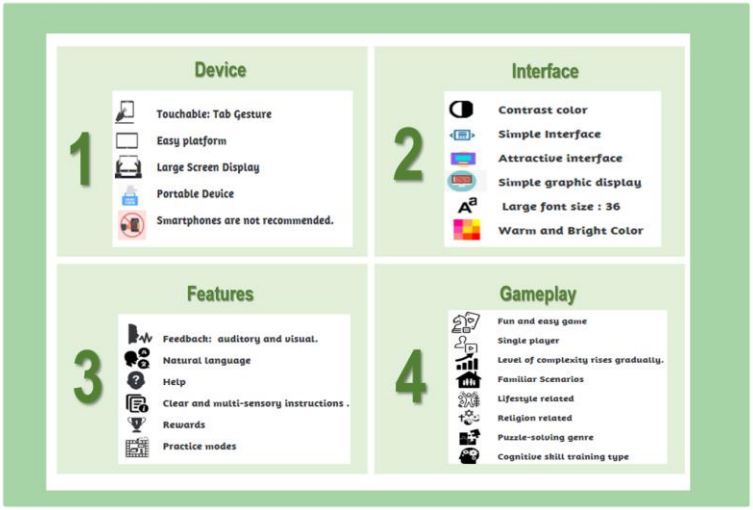

Figure 1: Guideline for psychotherapy game

A psychotherapy game, namely [Neuro]-therapy has been designed and developed based on the guideline which makes it different and special. This design meets all of the requirements by concentrating on the needs of the primary target consumers, who are the elderly. The layout, combination of colours, size and arrangement of buttons are carefully designed to suit the elderly. Selected interfaces of [Neuro]-therapy are shown in Figure 2.

Figure 2: Selected interface of [Neuro]-therapy game

This [Neuro]-therapy is designed with a set of jigsaw puzzles which consists of three main categories which are familiar to elderly; classic, face, and edibles. Players must put together the puzzles of a certain image to get a whole picture. To reflect the capacity of memory recall, the puzzles are constructed with a variety of difficulty levels. There's also a button that shows a hint for the puzzle and a button that lets the player pick which image type to promote additional user interaction. In addition, the game's background music creates a relaxing and tranquil psychotherapy setting.

Three sessions of game-based psychotherapy experiment have been conducted at Rumah Seri Kenangan (RSK) Bedong, Kedah involving ten residents with neurofeedback approach. The experiment subjects are required to wear an EEG reader device before to the experiment in order to record their brain signals while playing a Neuro-therapy game. To measure their performance in solving ask while

playing [Neuro]-therapy game, time taken are recorded using time function incorporated in the game. The finding shows that their capability of solving the task is improved in terms of duration. Experiences during the sessions have been observed and recorded.

3. Results and Discussion

Utilization of Neuro-therapy game in series of psychotherapy experiments have produced many interesting findings. Participants have shown some improvements in terms of memory recall. It shows through the improvement of time taken to solve the puzzles. They took longer time to solve the puzzles during the first session but shows significant improvement in the following sessions after numerous of trainings. Figure 3 shows improvement of memory recall among elderly when utilizing Neuro-therapy for three psychotherapy experiments.

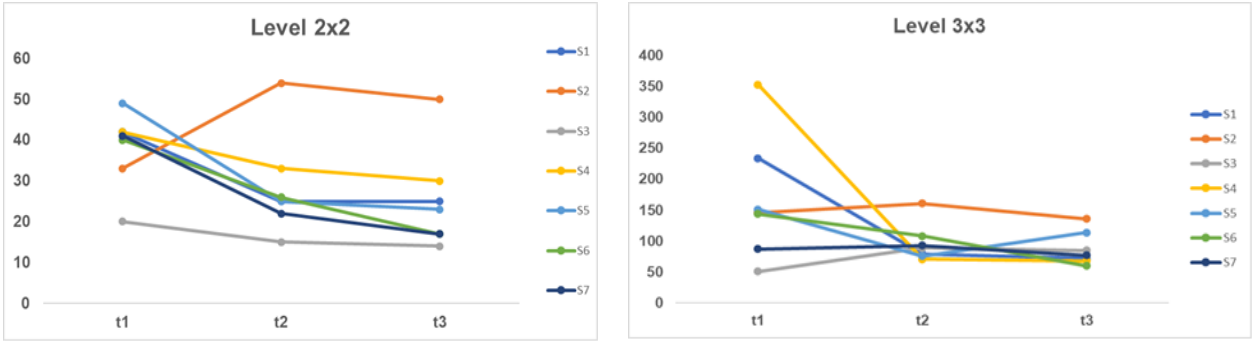

Figure 3: Selected interface of [Neuro]-therapy game

There are some other interesting impacts that have been discovered throughout the experiments including the improved skills and IT literacy among elderly. Neuro-therapy can be used as a tool in bridging the digital divide among the elderly. The acceptance of the proposed Neuro-therapy game and perceptions on the utilization of technology among elderly cannot be denied. It is also discovered that this study contributed to the improvement of IT-literacy for the elderly, consequently bridging the digital divide among elderly. Observation throughout experiments also shows that the skills and gesture of handling technology among elderly have been improved.

4. Conclusion

A mobile psychotherapy game, [Neuro]-therapy is successfully designed, developed, and evaluated. Game-based psychotherapy sessions have been successfully conducted at Rumah Seri Kenangan, Bedong Kedah by utilizing [Neuro]-therapy. Psychotherapy experiments were conducted during the period of Movement Control Order (MCO). [Neuro]-therapy game that have been provided to RSK has become an alternative to elderly who are restricted from outside world during MCO. The game is intended to help patients with memory disorder as well as increase their IT-literacy. It is hoped that it would provide suitable tool for memory impairment patients, so increasing the quality of life for the elderly with memory problems.

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