Review Article

Game Design to Diagnose and Improve Cognitive Disorders

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Abstract

Today, cognitive impairment is a disease that is both latent and overt. Cognitive impairment directly targets the senses and learning. A patient with cognitive impairment has a fundamental problem with remembering concepts. Solutions and plans have been considered for the treatment and control of this disease, from behavior and speech therapy to drug treatments. One of the ways to treat and control this disease is the use of game therapy, which is strengthened by using the patient›s memory and concentration in this game. In this article, the game is primarily designed with a map, in which a character is looking for treasure on an island, and the patient must find the treasure by using creativity and memory. Due to the limited time, this article is reported in a preliminary form, and in the second article, the analysis of the game with patients is presented. In this article, the gameplay and design methods as well as the sample character output are presented.

Keywords: Cognitive Disorders, Senses and Study and Cognitive Game

1. Introduction

One of the problems that the world spends a lot on is cognitive disorders. Nearly 50 million people struggle with this problem, but since 2000, mobile cognitive games or CMG have been introduced to the world as one of the best ways to improve these disorders. Dr. Kawashima introduced the game in 2006. With the name "How old is your brain?" This game was one of the first CMG games. Concentric diseases affect memory, reasoning, brain processing speed [1, 2]. But by using cognitive games, we can cause improvement in affected people. The key ability of the brain in learning neuroplasticity is that as age increases, the neuroplasticity of the brain decreases. For example, a 17-year-old person is more comfortable than a 27-year-old person learning a new skill [3]. According to data from the World Health Organization, by 2050, the number of people over the age of 60 will reach 2 billion, which is twice the current number [4]. A group of scientists and programmers designed games with which to measure the progress in cognitive abilities of people between the ages of 60 and 80. The test conditions were such that a group of 1,200 people played these games in 100 sessions. Games that each affect specific parts of the brain's activities [5].

CMG	Instruction	Main cognitive abilities trained	Time per CMG (s)	Total training time (min)	Scoring system	Processing speed
Square Numbers	Match the target shown on top by adding two or more number blocks	Quantitative reasoning Arithmetic Working memory	70	117	Base score for each correct answer with a speed related bonus (50 − (elapsed seconds × 5)) Streak up after 4 correct rounds, down after 5 incorrect	The processing speed is measured as the inverse of the average time to perform the different calculations
Memory Sweep	Memorize the positions of the highlighted tiles and remember their positions when gone	Attention Spatial memory Working memory	90	150	Points for each correct square (250) plus a base score for complete round Streak up (bonus) after 1 correct answer, down after 1 incorrect move	NA
Word Pair	Pair words according to a specific rule presented (similar, opposite)	Semantic access Vocabulary	90	150	Base score for correct round, streak up after 2 correct answers, down after 2 incorrect	The processing speed is measured as the inverse of the average time to pair the different words
Babble Bots	Create the maximal number of words of at least 3 letters with the 6 available letters	Word fluency Vocabulary	60	100	Points for letters in word multiplied by the word length, as the streak multiplier. Letter scores are localised to the region based on the Scrabble scoring system	NA
Must Sort	Sort the items correctly by tapping on the correct side	Response control Task shifting	45	75	Base score multiplied by streak multiplier, streak is incremented by correct answers and is reduced to 1 on incorrect or more than 5 s between answers	The processing speed is measured as the inverse of the average time between when the card appears and taping on the screen
Unique	Find the odd one out and tap on it	Visual attention Visual recognition	70	117	Baseline score per correct answer based on difficulty level. Delta is added to the baseline and becomes larger with consecutive correct answers (Baseline + (streak × delta)). Streak of 8 correct up, 6 down	The processing speed is measured as the inverse of the average time between when the objects appear and the discovery of the unique object
Rush Back	Memorize a shape, then decide if the next shape matches the one memorized	Sustained attention Visual recognition Working memory	45	75	One base score per difficulty level with a multiplier which goes up and down based on streak Streak up of 4 correct in a row but not changed during game play Bonus for end of game, current streak multiplier × bonus	The processing speed is measured as the inverse of the average time between when the card appears and the classification

Figure 1: Review of Games Designed by A Group of Former Experts in the Field of Cognitive Impairment.

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The results obtained from this experiment showed that people between the ages of 65-60 have a greater ability to strengthen their cognitive abilities by using CMG, but people between the ages of 75-80 also experience significant changes in their cognitive abilities. They do [6].
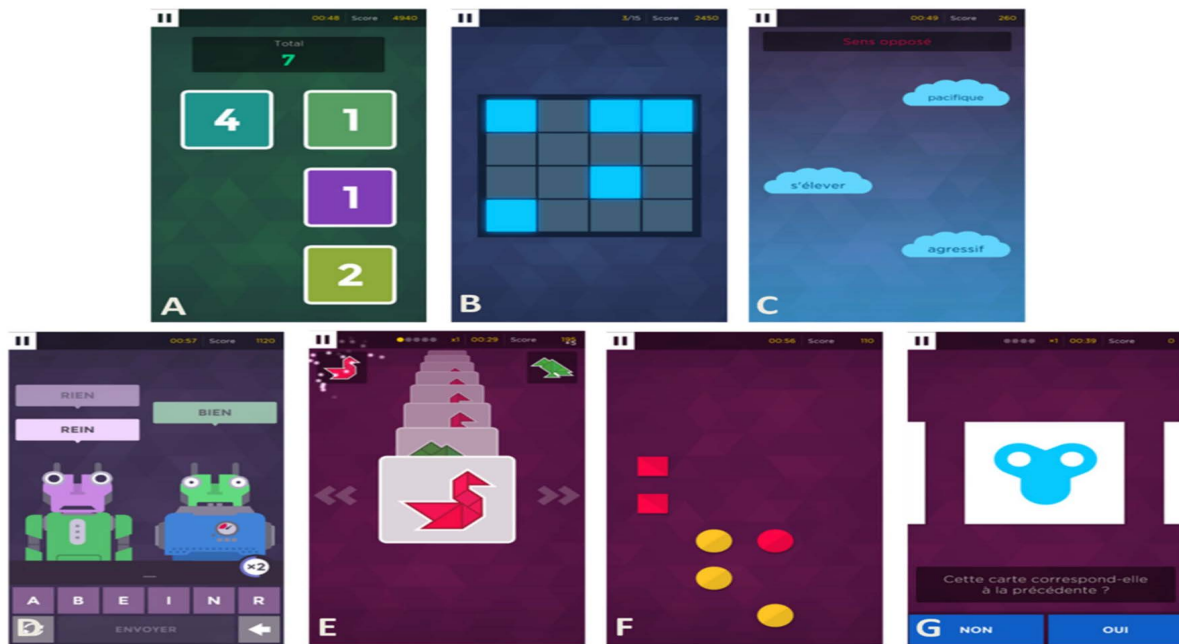

Figure 2: Games Designed by A Group of Former Experts in the Field of Cognitive Impairment.

One of the people who worked on this article is Ms. Barbara Jacklin Sahakian, who also worked on the Spades game. Spade is a CMG that helps to recognize using this game. The games of spades are like this: in the first stage you have a game that you have to pass, using memory, but. In the next stage, you have to display your action quickly or the selection of numbers is from the smallest to the largest actions and the next game has to be played with. Save points. It is forbidden. Connect two dots on the checkerboard. These games start from very simple and basic levels and increase in difficulty over time. Playing these games continuously increases memory, processing, problem-solving ability, etc.

2. Method
Game scenario and story
The story is that Monsieur, the main character of the story, lives in a post-disaster world and must go to a refugee camp for survivors on a remote island to escape the harsh world in which life has become extremely difficult. After months of searching, he found a map to the camp that showed the location of a key to enter it. The key was divided into three parts and hidden on three strange islands [7-14].

Map game
Near the first island, Monsieur's boat has sunk, and he barely reaches an abandoned village where the player gets to know the game system. After completing the training phase, the player has complete control and can go to the next phase. The next stages are optional, meaning that the player can go to different places after the village, for example, a motel or a city. Each location has its own story, written in a way that entertains the player and motivates the person to complete the levels and, while playing, strengthens skills including memory and brain processing

- City
- Motel
- Cemetery
- Mountains and deserts

Figure 3: Game Map.

Figure 4: Supplementary Map of the Game.

Figure 5: Character design

Analyz

To design this character, he was inspired by characters like Indiana Jones. Because paying attention to the story of this character's game is placed in situations like this series of films, which measure and challenge the player in terms of memory and speed of action [14-22]. Therefore, the design of the character should also be compatible with the environment and the feeling of the player, and the player should put himself in the place of the character and be able to have a deep experience to maximize the impact of the game.

3. Conclusion and Discussion

one of the problems that the world is facing is cognitive disorders. Nearly 50 million people struggle with this problem, but since 2000, mobile cognitive games or CMG have been introduced to the world as one of the best ways to improve these disorders. In this article, scenario and game design It has been proven that playing this game continuously increases memory, processing, problem solving ability, etc. The story is that Monsieur, the main character of the story, lives in a post-disaster world and must go to a refugee camp for survivors on a remote island to escape the harsh world in which life has become extremely difficult. After months of searching, he found a map to this camp that shows the location of a key to enter it. This key is divided into three parts and hidden in three strange islands. It is found that the ability to create games Fakhri can help to solve the problem of cognitive disorder in patients

References

1. Porvahad A, Amiri Majd M, (2016). The relationship between mother's psychological problems and family violence with behavioral problems of mentally retarded children, social health. Number 2. Pages: 110-117.
2. Sheykhi, M. T. (2016). State of widowhood in Iran: Challenges of ageing spouses. International Journal on Ageing in Developing Countries, 1(1), 54-67.
3. HASANABADI, F., HABIBI, A. M., KHOSHKONESH, A. (2017). Comparing dysfunctional attitudes, procrastination and decision-making styles in addicted, with and without relapse.
4. Reiman, E. M., Quiroz, Y. T., Fleisher, A. S., Chen, K., Velez-Pardo, C., et al. (2012). Brain imaging and fluid biomarker analysis in young adults at genetic risk for autosomal dominant Alzheimer's disease in the presenilin 1 E280A kindred: a case-control study. The Lancet Neurology, 11(12), 1048-1056.
5. Jack Jr, C. R., Lowe, V. J., Weigand, S. D., Wiste, H. J., et al. Alzheimer's Disease Neuroimaging Initiative. (2009). Serial PIB and MRI in normal, mild cognitive impairment and Alzheimer's disease: implications for sequence of pathological events in Alzheimer's disease. Brain, 132(5), 1355-1365.
6. Sato, C., Barthélemy, N. R., Mawuenyega, K. G., Patterson, B. W., Gordon, B. A., et al. (2018). Tau kinetics in neurons and the human central nervous system. Neuron, 97(6), 1284-1298.
7. Anguera, J. A., Boccanfuso, J., Rintoul, J. L., Al-Hashimi, O., Faraji, F., et al. (2013). Video game training enhances cognitive control in older adults. Nature, 501(7465), 97-101.
8. Bailey, K., West, R. (2013). The effects of an action video game on visual and affective information processing. Brain research, 1504, 35-46.
9. Bavelier, D., Davidson, R. J. (2013). Games to do you good. Nature, 494(7438), 425-426.
10. Blacker, K. J., Curby, K. M., Klobusicky, E., Chein, J. M. (2014). Effects of action video game training on visual working memory. Journal of Experimental Psychology: Human Perception and Performance, 40(5), 1992.
11. Cardoso-Leite, P., Bavelier, D. (2014). Video game play, attention, and learning: how to shape the development of attention and influence learning. Current opinion in neurology, 27(2), 185-191.
12. Clemenson, G. D., Stark, C. E. (2015). Virtual environmental enrichment through video games improves hippocampal-associated memory. Journal of Neuroscience, 35(49), 16116-16125.
13. Chang, C. H., Pan, W. W., Chen, F. C., Stoffregen, T. A. (2013). Console video games, postural activity, and motion sickness during passive restraint. Experimental brain research, 229, 235-242.
14. Zvyagintsev, M., Klasen, M., Weber, R., Sarkheil, P., Esposito, F., et al. (2016). Violence-related content in video game may lead to functional connectivity changes in brain networks as revealed by fMRI-ICA in young men. Neuroscience, 320, 247-258.
15. Anderson, K., Grossberg, G. T. (2014). Brain games to slow cognitive decline in Alzheimer's disease. Journal of the American Medical Directors Association, 15(8), 536-537.

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Ciatation:Veshareh, A. E. (2024). Game Design to Diagnose and Improve Cognitive Disorders. Journal of Theoretical Physics & Mathematics Research. 2(2), 1-4.　　**Page 3 of 4**

16. Deveau, J., Jaeggi, S. M., Zordan, V., Phung, C., Seitz, A. R. (2015). How to build better memory training games. Frontiers in systems neuroscience, 8, 243.

17. Boot, W. R., Champion, M., Blakely, D. P., Wright, T., Souders, D., et al. (2013). Video games as a means to reduce age-related cognitive decline: attitudes, compliance, and effectiveness. Frontiers in psychology, 4, 39121.

18. Foster, P. P. (2015). Role of physical and mental training in brain network configuration. Frontiers in Aging Neuroscience, 7, 117.

19. Pietrzak, E., Pullman, S., McGuire, A. (2014). Using virtual reality and videogames for traumatic brain injury rehabilitation: a structured literature review. GAMES FOR HEALTH: Research, Development, and Clinical Applications, 3(4), 202-214.

20. Gong, D., He, H., Liu, D., Ma, W., Dong, L., et al. (2015). Enhanced functional connectivity and increased gray matter volume of insula related to action video game playing. Scientific reports, 5(1), 9763.

21. Shams, T. A., Foussias, G., Zawadzki, J. A., Marshe, V. S., Siddiqui, I., et al. (2015). The effects of video games on cognition and brain structure: potential implications for neuropsychiatric disorders. Current psychiatry reports, 17, 1-15.

22. Szycik, G. R., Mohammadi, B., Hake, M., Kneer, J., Samii, A., et al. (2017). Excessive users of violent video games do not show emotional desensitization: an fMRI study. Brain imaging and behavior, 11, 736-743.

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