Research Plan

I. Description of Research Topic

Video games are highly engaging for children and facilitate improvements in cognition and behavior in children. An estimated 97% of American children play games for at least one hour per day, so it is necessary to understand that role games play in cognitive development. Given the controversy over violent games and their relationship to school shootings, there is a wealth of studies published on the negative impact of games. However, research on the potential benefits of games is an underdeveloped area of study, even though positive effects on cognition and behavior have been observed (Granic et. al, 2014).

Research that dives deep into which aspects of game design benefit which aspects of cognition is a new field. Given the broad nature of existing research, I aim to narrow the scope to a specific aspect of cognition that may benefit from video game use. Games show potential to improve players' time management skills; some games are specifically designed with this purpose, and many mass market games incorporate elements that challenge the player's time management ability. I will review and evaluate a selection of games with time management elements and assess specific design elements that have potential to improve these skills in players.

II. Motivation for Research

My long-term goal is to work on games that aid in the cognitive development of people with ADHD. ADHD is a common disorder that is associated with a myriad of cognitive deficits, including difficulty paying attention to details, staying focused for prolonged periods, difficulty listening in class and completing assignments, task avoidance, and time management (Parekh, 2017). Without effective treatment, ADHD can lead to anxiety, depression, and substance abuse (Sonuga-Barke, 2003; Rapport et. al, 2009; Zental et. al, 2012; Humphreys et. al, 2015). Because games may improve aspects of cognition that are deficit in ADHD children, they have potential to improve their cognition and help them lead healthy, happy, and productive lives.

It is imperative that teachers and parents employ intervention methods early in a child's development. Therapy and stimulants are effective for helping children with ADHD, and research has shown that games are effective as an adjunct method. However, if children lack access to therapy or medication, games may be an affordable and effective alternative intervention method. If games are the only intervention method that

a child has access to, they are in a unique position to provide quality treatment. Games have cognitive/behavioral benefits for ADHD children, and serious games are currently being developed for ADHD children, but further research is needed (Zental et. al, 2012; Bul et. al, 2016; Crepaldi et. al, 2017; Pandian et. al, 2021). By focusing on one area of cognitive function I hope to identify the design elements that support this function. I will direct my research toward time management, a deficit in people with ADHD, and evaluate games with time management as a core design component.

III. Research Question

I am studying video games with time management design elements, because I want to find out if games can be beneficial to players' time management skills, in order to help design games with elements that enhance these skills, so that people with cognitive deficits (such as ADHD) can play games to improve their time management skills and cognition.

IV. Research Method

My research method will include critical discourse analysis and qualitative empirical research. I will create a list of games to review and identify their design components related to time management. I will cross reference my findings for consistent elements, and select games based on my analysis for testing. After narrowing down a selection of games, I will ask study participants to play these games and fill out a questionnaire based on their experience. Group A will play games specifically designed for time management, Group B will play a commercial title with time management elements, and Group C will play a game without explicit time management elements.

I will evaluate each game based on this list of criteria:

Time limitations. I will examine what time constraints each game imposes on the player. Some games are designed with a long-term time limit, meaning that the player has a set amount of time to complete the entire game. Other games impose short-term time limits, based on completing levels or tasks within a set time frame. Strategy games demand players manage their time on a moment-to-moment basis throughout the experience.

Skills and resources. Games typically provide players with a set of skills and resources to help them solve a given task. These often have finite use but give the player advantages over restrictions imposed by the game's design.

Alternative time factors. Many games are not designed with an explicit time requirement, but still demand that players manage their time and resources carefully. For example, an action game may impose a time restraint by confronting the player with a high-pressure situation, where they must determine an efficient strategy to survive an encounter or solve a problem.

Difficulty and engagement level. Games should be easy enough so that the player does not feel punished, but difficult enough to be challenging and engaging. Games with very low difficulty can be boring and may not enhance cognitive function in players. To design a game that improves cognition, players should be sufficiently engaged in play so that they will want to continue playing over time, to facilitate skill development.

Accessibility. Barrier to entry can be a challenge for many players, for example VR games require people to invest in expensive gear. Games designed to improve cognition should be accessible at low cost to the consumer, especially if games are used as a cognitive improvement method in absence of means or access to therapy and medication. Games should also be playable for those with disabilities.

Games chosen for review will be divided into 3 categories: time management skill games, games with time management elements, and games without explicit time management elements.

Group A - An example of a time management skill game:

Diner Dash. In this free game, the player manages a diner, seats customers, serves meals and delivers checks with a time constraint. The customers' moods are represented by hearts above their head; completing service with full hearts means the player will receive the highest tip. As time passes, the customer's mood decreases, and the monetary reward decreases as well. The player has skills at their disposal to alleviate the time constraint for each customer, by talking with them or delivering drinks. The money the player earns is used to upgrade the restaurant and acquire new restaurants, providing the player with a long-term goal to motivate short-term performance.

Group B - An example of a game with time management elements:

The Legend of Zelda: Majora's Mask. In this action adventure game, players assume the role of Link, who must save a town from the moon, which will crash into the earth in three days. The three-day countdown is always visible to the player at the bottom of the screen, urging them to act quickly and efficiently. At the end of the countdown, the player can rewind back to the dawn of the first day. With this reset, the state of the world returns as well, but the player holds onto any skills and equipment they acquired, and

any useful knowledge about the world. The player also has access to a journal that keeps track of time sensitive events that they discover in each cycle. Completing these events rewards the player with upgrades and equipment to help them on each new cycle. After gathering enough power and completing four mandatory goals, the player can face the final boss, which gives the player incentive to maximize their efficiency in each run.

Group C - An example of a game without explicit time management elements:

Doom Eternal is a first-person shooter with a very simple goal: kill demons taking over Earth. The game demands little of the player in terms of long-term planning, outside of a simple upgrade system. The core gameplay loop: the player traverses an environment, fights a group of demons, and repeats until they reach the end of the level. The time management demand emerges from the combat itself. In combat, the player is faced with many adversaries, each with different strengths and weaknesses. The aggressiveness of the enemies demands that the player is in constant motion, making rapid decisions on where to move to avoid attacks, which weapons and skills to use based on the type of enemy, and manage their reserves of health and resources. If players do not manage their time effectively, they will be defeated swiftly. If they fight efficiently, they keep more resources to help them in the next battle.

Participants in groups A, B, and C will play their game for 2 hours and will answer a questionnaire with the following questions:

1. Did you have fun playing the game? Would you like to continue playing?
2. Was the game too hard or too easy? Was the game engaging?
3. Did the game make you feel stressed or anxious? If so, why?
4. Did the game require you to implement real-life time management skills? If so, what were they?
5. Do you believe that playing this game for an extended period would be beneficial to your time-management skills?
6. Are there any specific elements of the game that you helped you manage your time? What were they?

I will analyze the questionnaires for common answers and using this data I intend to determine if further research is warranted and create a springboard for detailed quantitative analysis.

V. Null and Alternative Hypotheses

Null Hypothesis: Video games do not improve the time management skills of those who play them.

Alternative Hypothesis: Video games that incorporate time management elements significantly improve the time management skills of those who play them.

VI. Research Timeline

Months 1 and 2: I will review 12 games divided into the above three categories and analyze them according to my criteria. Then I will select one game from each category for use in the study.

Month 3: Organize and execute study. Collect questionnaires and analyze the results.

Month 4: Compile results and draw conclusions. Determine if further research into the cognitive benefits of games related to time management is worthwhile.

VII. Expected Challenges

Determining which games to include in the study will pose a challenge, given that it will be a result of my own subjective analysis. Whether or not a game is fun or challenging will be different depending on the person. I will try to step back from my own opinions and view games objectively. However, certain game types are not engaging to me, and are engaging to others.

Participants will also have varying cognitive strengths and weaknesses, so results may differ greatly from person to person. How much insight each participant will share on the questionnaire will vary as well. Accruing a large enough group to account for this variation will be a challenge.

Given the responses, it may still be difficult to ascertain which elements of game design are conducive to improving players' time management skills. Since participants will likely be college age, it will also be unclear whether games will have the potential to benefit children as well.

References

[1] Granic, I., Lobel, A., & Engels, R. C. M. E. (2014). The benefits of playing video games. American Psychologist, 69(1), 66–78. https://doi-org.ezproxy2.library.drexel.edu/10.1037/a0034857

[2] Parekh, R. (2017, July). What Is ADHD? Retrieved from https://www.psychiatry.org/patients-families/adhd/what-is-adhd.

[3] Sonuga-Barke, E. J. S. (2003). The dual pathway model of AD/HD: An elaboration of neuro-developmental characteristics. *Neuroscience & Biobehavioral Reviews*, *27*(7), 593–604. https://doi.org/10.1016/j.neubiorev.2003.08.005

[4] Rapport, M. D., Kofler, M. J., Alderson, R. M., Timko, T. M., & DuPaul, G. J. (2009). Variability of attention processes in ADHD. *Journal of Attention Disorders*, *12*(6), 563–573. https://doi.org/10.1177/1087054708322990

[5] Zentall, S. S., Tom-Wright, K., & Lee, J. (2012). Psychostimulant and sensory stimulation interventions that target the reading and math deficits of students with ADHD. *Journal of Attention Disorders*, *17*(4), 308–329. https://doi.org/10.1177/1087054711430332

[6] Humphreys, K. L., Galán, C. A., Tottenham, N., & Lee, S. S. (2015). Impaired social decision-making mediates the association between ADHD and Social Problems. *Journal of Abnormal Child Psychology*, *44*(5), 1023–1032. https://doi.org/10.1007/s10802-015-0095-7

[7] Bul, Kato, P. M., Van der Oord, S., Danckaerts, M., Vreeke, L., Willems, A., Van Oers, H. J., Van Den Heuvel, R., Birnie, D., Amelsvoort, T., Franken, I., & Maras, A. (2016). Behavioral outcome effects of serious gaming as an adjunct to treatment for children with Attention-Deficit/Hyperactivity Disorder: a randomized controlled trial. Journal of Medical Internet Research, 18(2), e26–e26. https://doi.org/10.2196/jmir.5173

[8] Crepaldi, Colombo, V., Baldassini, D., Mottura, S., & Antonietti, A. (2017). Supporting Rehabilitation of ADHD Children with Serious Games and Enhancement of Inhibition Mechanisms. *Virtual Reality and Augmented Reality*, 167–181. https://doi.org/10.1007/978-3-319-72323-5_11

[9] Pandian, Jain, A., Raza, Q., & Sahu, K. K. (2021). Digital health interventions (DHI) for the treatment of attention deficit hyperactivity disorder (ADHD) in children - a comparative review of literature among various treatment and DHI. *Psychiatry Research*, *297*, 113742–113742. https://doi.org/10.1016/j.psychres.2021.113742