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Dissecting Gameplay: How Genre, Emotion, and Physiology Shape Cognitive Performance in Gamers

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This study explores how video game genres influence cognitive functions, specifically attention, cognitive flexibility, and spatial memory. Unlike past research that treats gaming as a uniform activity, this project examines genre-specific effects, alongside emotional engagement, heart rate, and gender differences. Using a 10-week pre-post test design, participants will play genre-based games and complete cognitive assessments, physiological monitoring, and experience questionnaires. Findings aim to reveal how different types of gameplay impact cognition and emotional states, offering insights for educational, therapeutic, and ethical game design, while advancing research on individual responses to digital media.

Human-Computer Interaction. Video Games. Cognitive Training. Attention. Memory. Task Switching. Psychology.

1. INTRODUCTION

As the gaming industry continues to grow and diversify, understanding the cognitive and physiological effects of video games has become increasingly important. While existing research often explores the general effects of gaming on behaviour and cognition, it rarely accounts for differences in genre, mechanics, goals and mental demand on players. This may be attributed to earlier games offering limited variety in mechanics and complexity, ongoing challenges in categorising games, and rapidly evolving technologies that change how players interact with games.

This lack of specificity makes it difficult to identify which types of gameplay may enhance or impair individual cognitive abilities; suggesting a more nuanced and productive approach than broadly labelling the industry, such as assuming violent games are inherently harmful. Furthermore, little is known about how individual differences, such as gender, emotional state, enjoyment and physiological responses like heart rate, moderate these effects.

As video games reach record numbers of players, it is vital to understand their long-term effects on players. Genre-specific insights could inform the design of games tailored for educational purposes, therapeutic interventions and skill development, like board games or chess. Such insights may also help identify harmful gameplay patterns and design

elements, similar to those found in deceptive patterns and gambling research.

Investigating emotional and physiological responses, along with gender differences, offers a more refined and inclusive understanding of gaming's impact. Addressing these gaps can inform responsible game design, targeted cognitive training and behavioural therapies, while advancing research in human-computer interaction. Further research may also highlight how games impact individuals with mental health conditions such as Post-Traumatic Stress Disorder (PTSD), anxiety disorders and Obsessive-Compulsive Disorder (OCD).

2. BACKGROUND AND RELATED WORK

Since the early 2000s, research has increasingly focused on the positive effects of gaming. Studies now explore how video games enhance players abilities by comparing gamers and non-gamers, as well as tracking improvements in new players. Video Game Players (VGPs) tend to outperform Non-Video Game Players (NVGPs) across a range of cognitive domains. These include visual attention (Qiu et al., 2018), executive control (Glass, Maddox, and Love, 2013), visual short-term memory (Boot et al., 2008; Prena et al., 2018), and processing speed (Dye, Green, and Bavelier, 2009). These skills are valued for their relevance to real-world tasks like driving, learning, and problem-solving.

2.1 Genre-Specific Effects

Studies have shown that even brief gameplay sessions can produce measurable cognitive benefits in NVGPs (Bediou et al., 2018; Green and Bavelier, 2003). However, the extent of these benefits often depends on the type of gameplay and how closely its mechanics align with the cognitive functions being tested, supporting the idea that different game genres may enhance specific cognitive skills based on their unique mental demands.

Understanding genre-specific effects is essential for using games intentionally to enhance cognition. Bavelier and Green (2016) note that action games lead to clear cognitive gains and suggest that Role-Playing (RPG) and Real-Time Strategy (RTS) games may offer similar benefits. In contrast, less cognitively demanding genres may be more effective at promoting social behaviour and empathy.

Oei and Patterson (2014) proposed that video games enhance cognitive functions when their demands closely match those of the cognitive tasks being measured. Their study showed that transfer effects were limited unless the game and task shared similar cognitive demands and neural engagement. To explore this further, Dobrowolski et al. (2015) compared the cognitive performance of players of First-Person Shooter (FPS) and RTS games, two genres often grouped as 'Action' games, despite having distinct gameplay differences. Participants completed task switching and multiple object tracking assessments. RTS players outperformed both NVGPs and FPS players on the multiple object tracking task, though this was attributed to faster reaction times rather than cognitive flexibility. The authors suggest that broad genre labels like 'Action' may mask important differences in cognitive demands, causing past studies to conflate effects from diverse gameplay types. This underscores the need for more precise research on specific game genres and their unique cognitive impacts.

2.2 Other Influential Factors

Both Franceschini et al. (2021) and Greitemeyer, Traut-Mattausch, and Osswald (2012) emphasise the role of positive emotional experiences in shaping cognitive and behavioural outcomes from gameplay. Franceschini et al. (2021) found that enjoyment during gameplay is directly linked to cognitive improvements, such as enhanced reading speed and accuracy, suggesting emotional engagement can amplify the cognitive benefits of gaming. Similarly, Greitemeyer et al. (2012) demonstrated that positive social contexts within co-operative gameplay, even in violent games, can increase prosocial behaviour and reduce aggression outside the game, highlighting the influence of emotional tone and positive interpersonal dynamics on real-world behaviour.

Prior research indicates that cognitive abilities may vary across genders, suggesting the presence of potential gender-based differences (Romrell, 2013; Quaiser-Pohl, Geiser, and Lehmann, 2006; Upadhayay, 2014), which could influence performance on cognitive tasks related to video game play. To account for these potential differences, gender will be evaluated in this study. This will allow for a more comprehensive understanding of how video game genres impact cognitive performance across different demographic groups and individuals. By considering gender as a variable, the study can provide insights into whether any observed effects are consistent across genders or if there are notable gender-specific differences. Additionally, performance differences may arise from individual factors such as cognitive processing styles, thinking patterns, and the presence of neurological conditions.

2.3 Evolving Industry Landscape

Dale and Green (2017) explore the evolution of video games and gaming culture, highlighting the rise of hybrid genres and the growing complexity of genre classification. For example, the rise of 'Action-RPGs,' which blend action and role-playing elements. Some hybrids have even become distinct genres. It has become difficult to classify games in an era where gameplay often combines design elements typical of multiple genres. To address this ambiguity, this project will adopt the definitions provided by Dale and Green (2017) as a consistent framework, which identifies common gameplay mechanics, provides representative examples, and outlines potential cognitive effects associated with different genres. Their approach has been successfully applied by Bediou et al. (2023).

3. RESEARCH QUESTIONS & OBJECTIVES

The research question that this project aims to answer is 'in what ways do different video game genres influence cognitive performance, and what role do emotional states, physiological responses (such as heart rate), and gender play in shaping these outcomes?'

To answer this question this project aims to:

- (i) Assess how playing games from various genres influences performance on three cognitive tests taken immediately after gameplay sessions.
 - (a) H1: Players will show significant differences in cognitive performance across different genres and compared to a control group, reflecting the unique cognitive demands of each genre.

- (ii) Examine whether certain genres are more effective in enhancing specific cognitive skills.
 - (b) H2: Participants who play FPS games will show greater improvements in attention performance compared to other genres. In contrast, participants who play RTS games will demonstrate greater improvements in cognitive flexibility, while those playing puzzle games will show enhanced memory performance.
- (iii) Evaluate if participants' emotional states and gameplay experiences across different genres affect their cognitive performance, using self-report measures and questionnaires.
 - (c) H3: Positive emotional and gameplay experiences will correlate with better cognitive test results than negative experiences or frustration.
- (iv) Explore the relationship between heart rate changes during gameplay and cognitive test performance and examine whether higher heart rate levels influence cognitive outcomes.
 - (d) H4: Higher heart rates during gameplay will be associated with poorer cognitive performance, especially in tasks requiring focus, such as task-switching and memory.
- (v) Investigate whether participants' gender affects their engagement with different game genres, their emotional and physiological responses during gameplay, and their results on cognitive tests.
 - (e) H5: Males are expected to perform better in attention and cognitive flexibility tasks, while females may excel in memory tests, potentially influenced by gender preferences in game genres and hormonal factors (Upadhayay, 2014).
- (vi) Examine whether emotional and physiological responses during gameplay can be used to predict future cognitive performance outcomes.
 - (f) H6: Emotional states and heart rate patterns during gameplay will significantly predict subsequent cognitive test performance.

This research will be conducted in three phases over three years. Phase one, conducted in year one, will investigate the initial effects of different game genres on cognitive performance, considering gender and gameplay experience to establish baseline results. The project is currently in this phase, with data collection taking place between September and December 2025.

In the later stages of the project, emotional response and heart rate data will be incorporated to assess how psychological and physiological states influence cognitive performance after gameplay.

In the final phase, the second study will be repeated to determine whether these initial emotional and physiological reactions can reliably predict long-term cognitive outcomes, addressing hypothesis six.

These phases aim to uncover deeper patterns in how gameplay experiences shape cognitive function over time. This phased approach ensures robust, progressive evidence collection and allows for a deeper exploration of each research aim, ensuring a comprehensive understanding of the complex relationship between gameplay and cognitive function.

Each study will recruit approximately 50-75 university students who regularly play video games (minimum 5 hours/week). University students are commonly studied in gaming research due to their accessibility and high engagement with gaming. Participants will be grouped based on their preferred genre; First-Person Shooter (FPS), Real-Time Strategy (RTS), Role-Playing Game (RPG), Puzzle, and a Control group. Each group will play one game representative of their genre.

A Pre-Post Test design will be used across all three studies, following a 10-week structure. Weeks one and ten will involve cognitive assessments only, to establish baseline results and final measures without training effects. During weeks two to nine, participants will play their game for one hour per session, followed by cognitive tests and completion of the Game Experience Questionnaire (GEQ). This design allows evaluation of both immediate and cumulative gameplay effects on cognitive performance over time.

Prior research often explores cognitive domains such as visual attention, executive control, visual short-term memory, and general processing speed. This project will focus specifically on attention, cognitive flexibility, and spatial memory, as these skills are highly transferable to real-world tasks, such as driving. To assess these domains, this project will adopt cognitive tasks from Boot et al. (2008), whose work provides a clear categorisation of tasks based on the cognitive domains they are designed to assess. The three tasks used will be: Task Switching, the Corsi Block Tapping Test, and the Attentional Blink task, all of which are well-established in cognitive research.

4. METHODOLOGY & CURRENT STATUS

To measure player enjoyment, the study will use Parts one and three of the Game Experience Questionnaire (IJsselstein, Kort, and Poels, 2013), a widely used tool for assessing players' emotional and experiential responses across genres. This will be completed each gameplay session during weeks two-nine.

Heart rate will be used as a reliable, non-invasive indicator of stress and cognitive load, factors known to impact memory and learning (McEwen & Sapolsky, 1995). Following the approach used by Long et al. (2023), participants' heart rate will be continuously monitored during gameplay, recording the average, highest, and lowest readings. This will enable an evaluation of how players physiologically respond to the demands of different game genres.

5. EXPECTED CONTRIBUTIONS

By distinguishing between video game genres, this study will offer a more precise understanding of how specific types of gameplay influence cognitive domains, such as attention, cognitive flexibility, and spatial memory. This will address a key limitation in existing research, which often treats gaming as a homogeneous activity.

Incorporating emotional state, heart rate, and gender will provide a more comprehensive view of player responses. This approach will enhance our understanding of how diverse individuals experience gameplay and support more inclusive and ethically informed design practices. By identifying potentially harmful cognitive or emotional effects associated with certain genres or mechanics, this research contributes to more responsible and ethical game design standards. It will also provide empirical evidence relevant to ongoing discussions about deceptive game features and exploitative design elements.

The projects findings can directly inform the development of video games designed for educational, behavioural, and therapeutic purposes. For example, game genres found to improve cognitive flexibility, or attention could be leveraged in learning environments or cognitive rehabilitation programs for individuals with cognitive impairments.

The study's rigorous pre-post-test design, combined with genre grouping, emotional and physiological data, and validated cognitive tasks, provides a replicable framework for future research. This methodology could serve as a model for other studies seeking to explore complex interactions between digital media and cognitive performance including participants with mental impairments.

6. REFERENCES

Bavelier, D. and Green, C.S. (2016). 'The Brain-Boosting Power of Video Games.' *Scientific*

American, [online] 315(1), pp.26–31. doi: 10.1038/scientificamerican0716-26.

Bediou, B., Adams, D.M., Mayer, R.E., Tipton, E., Green, C.S. and Bavelier, D. (2018). 'Meta-analysis of Action Video Game Impact on Perceptual, Attentional, and Cognitive Skills.' *Psychological Bulletin*, [online] 144(1), pp.77–110. doi: <https://doi.org/10.1037/bul0000130>.

Bediou, B., Rodgers, M.A., Tipton, E., Mayer, R.E., Green, C.S. and Bavelier, D. (2023). Effects of action video game play on cognitive skills: A meta-analysis. *Technology, Mind, and Behavior*, [online] 4(1). doi: <https://doi.org/10.1037/tmb0000102>.

Boot, W.R., Kramer, A.F., Simons, D.J., Fabiani, M. and Gratton, G. (2008). 'The effects of video game playing on attention, memory, and executive control.' *Acta Psychologica*, [online] 129(3), pp.387–398. doi: <https://doi.org/10.1016/j.actpsy.2008.09.005>.

Dale, G. and Green, C.S. (2017). 'The Changing Face of Video Games and Video Gamers: Future Directions in the Scientific Study of Video Game Play and Cognitive Performance.' *Journal of Cognitive Enhancement*, 1(3), pp.280–294. doi: <https://doi.org/10.1007/s41465-017-0015-6>.

Dobrowolski, P., Hanusz, K., Sobczyk, B., Skorko, M. and Wiatrow, A. (2015). 'Cognitive enhancement in video game players: The role of video game genre.' *Computers in Human Behaviour*, 44, pp.59–63. doi: <https://doi.org/10.1016/j.chb.2014.11.051>.

Dye, M.W.G., Green, C.S. and Bavelier, D. (2009). 'The development of attention skills in action video game players.' *Neuropsychologia*, [online] 47(8-9), pp.1780–1789. doi: <https://doi.org/10.1016/j.neuropsychologia.2009.02.002>.

Franceschini, S., Bertoni, S., Lulli, M., Pievani, T. and Facoetti, A. (2021). 'Short-Term Effects of Video-Games on Cognitive Enhancement: the Role of Positive Emotions.' *Journal of Cognitive Enhancement*, 6. doi: <https://doi.org/10.1007/s41465-021-00220-9>.

Glass, B.D., Maddox, W.T. and Love, B.C. (2013). 'Real-Time Strategy Game Training: Emergence of a Cognitive Flexibility Trait.' *PLoS ONE*, 8(8), p.e70350. doi: <https://doi.org/10.1371/journal.pone.0070350>.

Green, C.S. and Bavelier, D. (2003). 'Action video game modifies visual selective attention.' *Nature*, [online] 423(6939), pp.534–537. doi: <https://doi.org/10.1038/nature01647>.

Greitemeyer, T., Traut-Mattausch, E. and Osswald, S. (2012). 'How to ameliorate negative effects of violent video games on cooperation: Play it cooperatively in a team.' *Computers in Human*

- Behaviour*, 28(4), pp.1465–1470. doi:
<https://doi.org/10.1016/j.chb.2012.03.009>.
- IJsselsteijn, W.A., Kort, Y.A.W. de and Poels, K. (2013). 'The Game Experience Questionnaire.' *research.tue.nl*. [online] Available at: <https://research.tue.nl/en/publications/the-game-experience-questionnaire>.
- Long, K., Zhang, X., Wang, N. and Lei, H. (2023). Heart Rate Variability during Online Video Game Playing in Habitual Gamers: Effects of Internet Addiction Scale, Ranking Score and Gaming Performance. *Brain Sciences*, [online] 14(1), p.29. doi:
<https://doi.org/10.3390/brainsci14010029>.
- McEwen, B.S. and Sapolsky, R.M. (1995). 'Stress and cognitive function.' *Current Opinion in Neurobiology*, [online] 5(2), pp.205–216. doi:
[https://doi.org/10.1016/0959-4388\(95\)80028-x](https://doi.org/10.1016/0959-4388(95)80028-x).
- Oei, A.C. and Patterson, M.D. (2013). 'Enhancing Cognition with Video Games: A Multiple Game Training Study.' *PLoS ONE*, [online] 8(3), p.e58546. doi:
<https://doi.org/10.1371/journal.pone.0058546>.
- Prena, K., Reed, A., Weaver, A.J. and Newman, S.D. (2018). 'Game Mechanics Matter: Differences in Video Game Conditions Influence Memory Performance.' *Communication Research Reports*, 35(3), pp.222–231. doi:
<https://doi.org/10.1080/08824096.2018.1428545>.
- Qiu, N., Ma, W., Fan, X., Zhang, Y., Li, Y., Yan, Y., Zhou, Z., Li, F., Gong, D. and Yao, D. (2018). 'Rapid Improvement in Visual Selective Attention Related to Action Video Gaming Experience.' *Frontiers in Human Neuroscience*, [online] 12. doi: <https://doi.org/10.3389/fnhum.2018.00047>.
- Quaiser-Pohl, C., Geiser, C. and Lehmann, W. (2006). 'The relationship between computer-game preference, gender, and mental-rotation ability.' *Personality and Individual Differences*, 40(3), pp.609–619. doi:
<https://doi.org/10.1016/j.paid.2005.07.015>.
- Romrell, D. (2013). 'Gender and Gaming: A Literature Review.' *36th Annual Proceedings: Selected research and development papers presented at the Annual Convention of the AECT*. 170-182.
- Upadhayay, N. (2014). 'Comparison of Cognitive Functions Between Male and Female Medical Students: A Pilot Study.' *Journal of Clinical and Diagnostic Research*, [online] 8(6). doi:
<https://doi.org/10.7860/jcdr/2014/7490.4449>.