Proceedings of 3rd International Conference on Interdisciplinary Humanities and Communication Studies
DOI: 10.54254/2753-7064/2024.23313

Understanding Game Addiction Mechanism

Xinyang Li

University of Toronto, Toronto, Canada
didididora1.0@gmail.com

Abstract: The widespread popularity of online games has raised concerns about addiction, which can affect physical and mental health. This paper explores the problem of online game addiction from physiological and psychological perspectives, with special emphasis on changes in brain activity and cognitive patterns. From a physiological perspective, online games stimulate the brain's reward system, and addictive behaviors are associated with alterations in the dopamine pathway as well as changes in brain regions such as the prefrontal cortex and ventral striatum. From a psychological perspective, gaming addiction is influenced by the perceived value of rewards in gaming, maladaptive gaming behaviors, reliance on gaming for self-esteem, and the search for social approval. Treatments for online game addiction mainly include cognitive-behavioral therapy (CBT) and pharmacological therapies (e.g., antidepressants), with the former helping to change maladaptive thoughts and behaviors. Future research should explore preventive measures from the perspective of game design, incorporate anti-addiction mechanisms, and strike a balance between entertainment and responsible gaming behavior.

Keywords: game addiction, mechanism, treatment

1. Introduction

Online games are hugely popular and this trend has continued unabated even during the recession. Recent studies have shown that video game continues to expand and innovate globally every year [1]. A comprehensive study of Internet users [2] emphasized that online gaming is one of the most addictive online activities, with its immersive and interactive nature contributing to increased engagement and highlighting this phenomenon, revealing that engaging qualities of online gaming make it particularly likely to lead to addictive behaviors, underscoring the need for increased awareness and responsible gaming behavior.

The influence of online games on people is multifaceted. For people with self-control or strong social skills, online games may be an effective way to relax and expand their social network [3]. However, for another part of people, the negative effects of online games outweigh the positive ones, so they may become dependent on the games, which will have an impact on their real lives. What needs people's concern and worry more is the concept called "online game addiction". It has been proved that the prevalence of gaming disorder all over the world seems to become comparable to obsessive-compulsive disorder and other substance-related addictions [4]. According to the study, addicted heavy online gamers were more depressed than non-addicted heavy gamers [5]. It can be seen that addictive behavior is directly linked to physical and mental health. In addition, addiction to online games may also cause problems in social relationships, emotions, and so on. Therefore, this

DOI: 10.54254/2753-7064/2024.23313

article will focus on online game addiction, mainly from two aspects to discuss the possible causes of online game addiction and related treatment methods.

The COVID-19 pandemic that began sweeping the globe a few years ago has fundamentally changed many aspects of daily life. As blocking and social distancing measures came into effect, people found themselves increasingly dependent on digital platforms to meet the challenges of the new normal. The surge in online activity became apparent as working remotely, virtual social interactions and online shopping became the norm. Within these booming digital areas, online gaming became a particularly visible and rapidly growing phenomenon. This is the starting point of this article.

The rapid growth of online gaming during this period is worthy of further study, particularly in terms of understanding the mechanisms behind gaming addiction. This addiction can be analyzed both physiologically and psychologically.

Physiologically, online games are designed to activate the brain's reward system. They often contain features that trigger the release of dopamine, a neurotransmitter associated with pleasure and reinforcement. For example, the instant gratification provided by game rewards, achievements, and progression can create powerful feedback loops that reinforce continued play. Over time, this leads to neurochemical changes that make the gaming experience increasingly engaging and irresistible.

Another psychological factor is the social dimension of online gaming. Many games offer multiplayer experiences and foster online communities, creating a sense of belonging and social connection that players may struggle to find elsewhere. This social engagement can be reinforcing, as players seek to maintain their status within these communities and avoid the negative feelings associated with disconnection. Other more detailed psychological factors will be discussed in the main text.

2. Literature review

References in this article were searched through Google Scholar and PubMed. The Research keywords are “online games”, “game addiction”, “adolescence online game playing”, “game mechanism”, “game addiction and gambling”,” brain reward system” and “treatment of game addiction “. After reading and screening, a total of ten articles will be analyzed in depth. By classifying the main themes of the article, this article will discuss the possible causes of online game addiction from two main perspectives: Human physiological response and behavior.

Before analysis, it is important to define what type of people fall into the category of online game addicts. There are a number of ways to determine whether or not someone is suffering from an online gaming addiction. In DSM-5, video game addiction is defined as the steady and repetitive use of the Internet to play games frequently with different gamers, which leads to clinically significant distress and psychological changes as demonstrated by five or more criteria in a year. Also, In DSM-5, IGD contains nine criteria, which could be helpful in judging whether addiction or not. Some scales are also helpful in judging online game addiction. For example, the Compulsive Internet Use Scale (CIUS) could assess the severity of compulsive Internet use [6]. Other methods like electrocardiograms (ECGs) are used to test the heart rate variability (HRV) parameters, which could Describe the level of gaming addiction [7].

3. Result

3.1. Physiological aspect

Online game addiction is a kind of non-substance addiction, this part aims to explore the relationship between game addiction and brain activity changes.

The addiction mechanism of the brain will be discussed first. Since games make it easy to produce pleasure, it is speculated that the brain addiction mechanism is related to the brain circuit, the brain

DOI: 10.54254/2753-7064/2024.23313

reward and punishment system, dopamine secretion, and so on. From reading multiple literature reviews, the formation process is roughly as follows: The decision to initiate addictive behavior is made by the brain, especially the prefrontal cortex and ventral striatum. Long-term use of the substance (in this case, long-term dependence on online games) can alter the brain's dopamine pathway. The most immediate effect is a reduced ability to control cravings for the substance [8]. At the same time, changes in brain regions such as the anterior cingulate gyrus can lead to a weakening of the natural reward response, which further reduces control [9]. Over time, the amounts of substances needed to achieve the same pleasure is increased, and the brain's reward system is disrupted, leading to the activation of the anti-reward system.

In the study by Chih-Hung Ko et. al [10], they identify the neural substrates of online gaming addiction through the evaluation of the brain areas associated with the cue-induced gaming urge. The design of the experiment is based on the Cue-reactivity paradigm, which aims to expose addicted individuals to stimuli designed to elicit craving while assessing concomitant changes in one or more response systems. The designers hope to get players to pay attention, get memory, and be interested in providing clues related to the game, and at the same time study their brain activity to confirm the neurobiological mechanisms of the game. The game cues selected Mosaic images that had been altered in the game to induce the participants' impulse to play the game. The use of technology includes functional magnetic resonance imaging (fMRI) scanning and SPM2 software (which is used to receive the blood-oxygen-level dependent signals). By comparing and analyzing the differences between the addiction group and the control group, the following six brain regions have the greatest likelihood of explaining gaming urges and game cravings: right orbitofrontal cortex, bilateral anterior cingulate and medial frontal cortex, right DLPFC (middle frontal cortex and adjacent superior frontal cortex), right nucleus accumbens, and right caudate nucleus. The greatest contribution of this study is the discovery of the neural mechanisms that induce addictive impulses in gaming addiction, guided by cue induction, which will benefit many aspects of subsequent research. First, researchers can take a closer look at these six regions and determine the specific role of each brain region in inducing gaming addiction. Second, it opens up new ways of thinking, and more research on gaming addiction can be cut from the trigger cues. Finally, it has significant implications for the prevention and treatment of gaming addiction and may be superior to other treatments from the perspective of intervention to induce impulsivity.

3.2. Psychological aspects

Online game addiction can be studied in depth from a cognitive perspective, exploring how these games affect mental processes such as thought formation, understanding, and perception. As online games have developed, they now have increasingly complex mechanics and immersive experiences. These improvements can dramatically alter players' cognitive patterns, which in turn can change the way they perceive and evaluate game experiences and real-life activities. For example, the constant stimulation provided by games, combined with instant rewards and engaging social interactions, can reorder properties of cognitive to make virtual worlds seem more immersive than real-life experiences. This cognitive shift enhances the game's allure, as players may become more addicted to the digital environment, leading to addiction.

The literature review by Daniel et al [11] summarized a total of 16 online gaming disorders (IGDs) into four main perspectives. These perspectives provide a comprehensive framework for understanding IGDs. A more specific analysis based on these four aspects is presented below

(1) Perceptions about game reward value and tangibility

Players who are addicted to online games often view the rewards in these games as virtual items, in-game currency, and apparel as highly valuable. This kind of perception may outweigh their evaluation of real-world rewards and experiences, including education, career development,

DOI: 10.54254/2753-7064/2024.23313

relationships, and physical health. The attraction of these virtual rewards can become so powerful that addicted players may place in-game achievements above important real-life responsibilities [12]. As a result, they become more involved in the game and thus devote more time and energy to gaming activities rather than focusing on real-world responsibilities and well-being.

(2) Maladaptive and inflexible game behavior rules

This kind of cognition can be understood as players continue to play despite being aware of the negative effects. This phenomenon can be analyzed through several cognitive biases and cognitive distortions. Daniel et al. propose four specific cognitive perspectives to account for this behavior: sunk cost bias, behavioral completion, prioritization of gaming behaviors, and maladaptation of games. Sunk cost bias refers to the tendency of players to stick with the game due to the time and resources they have already invested in it, even if they have recognized the adverse effects. Behavioral completion refers to players feeling compelled to complete in-game tasks or goals, often at the expense of real-life responsibilities. Game behavioral prioritization describes how games become the dominant focus, eclipsing other important activities and obligations. Gaming rule maladaptation reflects the adjustment of personal rules to justify excessive gaming, such as modifying schedules to accommodate more gaming time or bending social norms to accommodate gaming.

Addicts may try to hide the extent of their gaming, making up lies about their movements or playing down their gaming habits. For example, they may lie about being busy at work or minimizing the amount of time they spend gaming [13]. This kind of behavior entrenches their addiction and hinders efforts to address gaming addiction.

(3) Over-reliance on gaming to fulfill self-esteem needs

In Maslow's hierarchy of needs theory, self-esteem is the second level of needs after basic physiological needs and safety needs. This level consists of the desire for respect, recognition, and a sense of accomplishment. Many games fulfill this need by providing rewards, a sense of achievement, and social recognition, which can encourage people to continue playing the game. When players become too dependent on games to satisfy their esteem needs, they may temporarily enhance their self-worth through virtual accomplishments and peer recognition. However, it becomes terrible when this dependence obscures real-world achievements and interpersonal relationships. Over time, this dependency on games for self-esteem may result in gaming addiction as people increasingly seek recognition from games rather than from interactions and achievements that are meaningful in their daily lives. As a result, the initial entertainment quest may turn out to be a major barrier to personal growth and real-life socialization.

(4) Playing Games as a way to gain social acceptance

In the digital age, many people find it is much easier to achieve success in online games than in real life. This phenomenon can lead players to shift to virtual environments increasingly to get social recognition and personal acknowledgment. Games often provide a structured framework in which achievements are clear and straight, while real-world achievements tend to be ambiguous and lengthy. As a result, players may seek the recognition and sense of belonging provided by online games as a fast track to success. In addition, game developers have taken advantage of this trend by creating a competitive environment through mechanisms like leaderboards and ranking systems. These features encourage players to work towards higher rankings, thus verifying their skills and increasing their social status within the gaming community. The visibility of rankings not only stimulates the competitive spirit but also develops a sense of community and accomplishment. However, being over-dependent could also lead to a reliance on games to escape real-life responsibilities and failures, which in turn increases the player's addiction to the game.

In addition, online games can also provide players with a social platform. The results of this approach are twofold: some addicted players may develop an unbalanced lifestyle, but non-addicted players may benefit from a diverse social environment [5]. It is speculated that one of the reasons for

DOI: 10.54254/2753-7064/2024.23313

online game addiction is that online games provide players with opportunities for bold communication, players do not need to talk face to face, they just need to send texts or communicate behind their computer, which has fewer pressure of compared with face-to-face talking. In the study by Jeong, E. J. in 2011 [3], By creating a scale based on the DSM-IV to estimate the degree of Internet addiction, social self-efficacy is one of the dimensions. Self-efficacy is defined as ‘‘the conviction that one can successfully execute the behavior required to produce the outcomes and high self-efficacy stands for a stronger conviction to accomplish something. People with high levels of self-fulfillment are less likely to feel lonely.

The result shows a strong relationship between them. Online social self-efficacy is positively correlated with game addiction while offline social self-efficacy shows a negatively significant relationship with game addiction. This means that teenagers who feel lonely offline (in real life) will be more active in cyberspace because the Internet fulfills their need for communication, so they are more likely to be influenced by online games and more likely to become addicted to online games.

4. Treatment

CBT is by far the most common treatment for IGD [3]. Specifically, it includes control of stimulus, learning to adapt reactions properly, setting self-monitoring strategies, rebuilding their cognitive, addiction-related critical thinking, and exposure withdrawal regulation methods [1]. In Wolfling et al. 's experiment [14], they had an experiment based on short-term treatment for internet and computer game addiction (STICA), which is a manualized CBT program. A sample of 143 men was divided into treatment and control groups. The result shows that the self-reports of people in the treatment group reflected significantly fewer internet addiction (IA) symptoms, compared to the control group.

Medication is also widely used today. The medication trials that have been done were on drugs usually used to treat depression or attention deficit hyperactivity disorder (ADHD). Common drugs used to treat addiction include Modafinil, Amisulpride, Methadone, Varenicline, and so on. Not only that, many new drug treatments are being studied. An experiment by Han et al. [15] tested bupropion treatment for substance use. Online game addiction is similar to drug addiction. So far, bupropion has been used with a variety of antidepressants. It works by weakly inhibiting the reuptake of norepinephrine and dopamine, which are the negative effects of nicotine, cocaine drugs, etc. After six weeks of treatment, the experimental group of 19 male participants reduced their cravings for Internet video games, as well as the stimulation of cue video games.

Other therapies such as Mindfulness-based therapies (MBTs), Cognitive bias modification training (CBM), and talk therapy are also forms of treatment.

5. Discussion and conclusion

This paper provides an in-depth look at the multifaceted causes of online gaming addiction from both psychological and physiological perspectives. From a physiological perspective, studies have shown that changes in brain activity are an important factor in online addiction. Future research may benefit from a more detailed exploration of specific brain regions affected by gaming, potentially providing new insights into the neurobiological mechanisms of this phenomenon.

From a psychological perspective, online gaming addiction can be understood on multiple levels. Gamers typically develop specific beliefs about the rewards related to the game, resulting in a strong motivation to continue playing. The reasons for continued gaming may also occur as individuals justify their behavior to conform to personal or societal norms. In addition, gaming may be a source of self-esteem and social recognition, as players may gain a sense of accomplishment or social recognition from in-game achievements.

DOI: 10.54254/2753-7064/2024.23313

Among the available treatments, Cognitive Behavioral Therapy (CBT) is the most effective in treating Internet Gaming Disorder (IGD). CBT works by helping patients identify and change undesirable thoughts and behaviors associated with their gaming habits. Although CBT is the most commonly used approach, other treatments are still being developed and promise to address different aspects of online gaming addiction.

The current literature mainly deals with treatment strategies for online addiction in general and gaming addiction in particular. However, there is a significant lack of research on preventive measures from the perspective of game developers. Future research should explore how to integrate effective anti-addiction mechanisms into game design and operating strategies. By implementing features to monitor and manage players' online time, developers can play an important role in reducing the risk of addiction. This kind of proactive approach can help reduce the prevalence of online game addiction and strike a balance between the entertainment value of games and responsible gaming behavior.

References

[1] *King, D. L., Koster, E., & Billieux, J. (2019). Study what makes games addictive. Nature, 573, 346. Ko, C. H., Liu, G. C., Hsiao, S., Yen, J. Y., Yang, M. J., Lin, W. C., ... Chen, C. S. (2009). Brain activities associated with gaming urge of online gaming addiction. Journal of Psychiatric Research, 43, 739–747.*

[2] *Young KS. (1999) Internet addiction: Symptoms, evaluation, and treatment. www.netaddiction.com/articles/symptoms.htm.*

[3] *Jeong, E. J., & Kim, D. H. (2011). Social activities, self-efficacy, game attitudes, and game addiction. Cyberpsychology, behavior and social networking, 14(4), 213–221.*

[4] *Stevens MW, Dorstyn D, Delfabbro PH, King DL. Global prevalence of gaming disorder: A systematic review and meta-analysis. Aust N Z J Psychiatry. 2021 Jun;55(6):553-568. doi: 10.1177/0004867420962851. Epub 2020 Oct 7. Erratum in: Aust N Z J Psychiatry. 2023 Jun;57(6):928. doi: 10.1177/00048674221137011. PMID: 33028074.*

[5] *Van Rooij, A. J., Schoenmakers, T. M., Vermulst, A. A., Van den Eijnden, R. J., & Van de Mheen, D. (2011). Online video game addiction: identification of addicted adolescent gamers. Addiction (Abingdon, England), 106(1), 205–212. https://doi.org/10.1111/j.1360-0443.2010.03104.x*

[6] *Meerkerk, G. J., Van Den Eijnden, R. J., Vermulst, A. A., & Garretsen, H. F. (2009). The Compulsive Internet Use Scale (CIUS): some psychometric properties. Cyberpsychology & behavior: the impact of the Internet, multimedia and virtual reality on behavior and society, 12(1), 1–6. https://doi.org/10.1089/cpb.2008.0181*

[7] *Kim J-Y, Kim H-S, Kim D-J, Im S-K, Kim M-S. Identification of Video Game Addiction Using Heart-Rate Variability Parameters. Sensors. 2021; 21(14):4683. https://doi.org/10.3390/s21144683*

[8] *Goldstein RZ, Volkow ND. Am J Psychiatry. 2002; 159:1642–1652. Drug addiction and its underlying neurobiological basis: neuroimaging evidence for the involvement of the frontal cortex.*

[9] *Everitt BJ, Robbins TW. Neural systems of reinforcement for drug addiction: from actions to habits to compulsion. Nat Neurosci. 2005;**8**: 1481–1489. https://doi.org/10.1089/cyber.2009.0289*

[10] *Chih-Hung Ko, Gin-Chung Liu, Sigmund Hsiao, Ju-Yu Yen, Ming-Jen Yang, Wei-Chen Lin, Cheng-Fang Yen, Cheng-Sheng Chen, Brain activities associated with gaming urge of online gaming addiction, Journal of Psychiatric Research, Volume 43, Issue 7, 2009, Pages 739-747, ISSN 0022-3956, https://doi.org/10.1016/j.jpsychires.2008.09.012.*

[11] *Daniel L. King, Paul H. Delfabbro, The cognitive psychology of Internet gaming disorder, Clinical Psychology Review, Volume 34, Issue 4, 2014, Pages 298-308, ISSN 0272-7358, https://doi.org/10.1016/j.cpr.2014.03.006.*

[12] *S.E. Allison, L. von Wahlde, T. Shockley, G.O. Gabbard, The development of the self in the era of the Internet and role-playing fantasy games*

[13] *Young K. Am J Fam Ther, Understanding online gaming addiction and treatment issues for adolescents. 2009; 37: 355–372.*

[14] *Wölfling, K., Müller, K. W., Dreier, M., Ruckes, C., Deuster, O., Batra, A., Mann, K., Musalek, M., Schuster, A., Lemenager, T., Hanke, S., & Beutel, M. E. (2019). Efficacy of Short-term Treatment of Internet and Computer Game Addiction: A Randomized Clinical Trial. JAMA psychiatry, 76(10), 1018–1025. https://doi.org/10.1001/jamapsychiatry.2019.1676*

[15] *Han, D. H., Hwang, J. W., & Renshaw, P. F. (2010). Bupropion sustained release treatment decreases craving for video games and cue-induced brain activity in patients with Internet video game addiction. Experimental and clinical psychopharmacology, 18(4), 297–304. https://doi.org/10.1037/a0020023*