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Analysis of the Mechanisms of Addiction in Games

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Abstract. Internet gaming has rapidly become a global pastime, yet a minority of players develop Internet Gaming Disorder (IGD), characterized by impaired control, escalating priority given to gaming and continued play despite negative consequences. The prevalence of IGD varies from about 0.3%-1% of the general population to 7.4% in Macau university students and 2.27% among Chinese adolescents. This paper synthesizes research on the mechanisms that make games addictive and the factors that predispose individuals to IGD. Data from peer-reviewed studies and government reports were reviewed to summarize diagnostic criteria, prevalence estimates, reward-related neurobiology, social and motivational mechanisms, weakened impulse control and evidence-based interventions. Tables compare DSM-5 and ICD-11 definitions and categorize risk factors, and a bar chart illustrates prevalence across regions. The analysis reveals that variable reward schedules stimulate dopaminergic pathways, games satisfy psychological needs for competence, autonomy and relatedness, and IGD involves poorer response inhibition and prefrontal dysfunction. Social isolation, male gender, impulsivity and parental rejection amplify risk. Cognitive behavioral therapy and motivational interviewing have emerged as promising interventions. Understanding these mechanisms informs prevention, design ethics and treatment of gaming disorder.

Keywords: Internet gaming disorder, reward system, self-determination theory, impulsivity, neurobiology

1. Introduction

The global gaming industry boasts hundreds of millions of players, and for most people, games are a source of entertainment and social connection. However, an increasing research warns that excessive gaming can lead to a behavioral addiction known as Internet Gaming Disorder (IGD). The American Psychiatric Association notes that approximately 0.3%–1% of the general population may meet diagnostic criteria [1]. Among specific groups, the prevalence can be much higher: a study of Macau university students reported a prevalence of 7.4% and a national survey of Chinese adolescents found a rate of 2.27% [2,3]. These figures underscore the need to understand why some players transition from enthusiastic engagement to pathological involvement.

Research on IGD has progressed rapidly over the past decade. Early work focused on the epidemiology of excessive gaming, demonstrating associations with depressive symptoms, anxiety and poor academic performance. More recent studies have turned to neurobiology and motivational

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psychology to examine how reward circuits, self-determination, social belonging and self-control interact. Yet gaps remain: most research is cross-sectional and cannot determine causality, few studies integrate psychological and neuroscientific findings, and cultural differences are under-explored. This paper aims to synthesize available evidence on the mechanisms that make games addictive and the factors that predispose individuals to IGD. Specifically, it reviews diagnostic criteria, prevalence and risk factors; analyses reward mechanisms and reinforcement schedules; examines how games satisfy psychological needs and create social identity; explores neurobiological and cognitive deficits underlying impulse control; and discusses implications for intervention and ethical game design. Through this integrative approach, this paper seeks to inform researchers, clinicians and game developers.

2. Definition and scope of gaming addiction

2.1. Diagnostic frameworks

IGD appears in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) [1] as a condition for further study and in the World Health Organization's International Classification of Diseases (ICD-11) as a formal disorder. The DSM-5 uses nine criteria, including preoccupation, withdrawal, tolerance, and loss of control. The ICD-11 focuses on impaired control, growing priority given to gaming, and continued play despite harm. Both systems require significant impairment and a pattern that lasts for at least 12 months. Table 1 compares the two frameworks.

Table 1. Comparison of DSM-5 and ICD-11 diagnostic criteria for gaming disorder

Feature	DSM-5 (Internet gaming disorder)	ICD-11 (Gaming disorder)
Core criteria	Five or more of nine symptoms: preoccupation, withdrawal, tolerance, inability to reduce play, loss of other interests, continued use despite problems, deceit of others, gaming to escape negative mood, and jeopardizing relationships or opportunities.	Impaired control over gaming, increasing priority given to gaming over other activities, and continuation or escalation of gaming despite negative consequences.
Duration & requirement	Symptoms present for ≥ 12 months; diagnosis requires significant distress or impairment.	Behavior pattern evident for ≥ 12 months (shorter if symptoms are severe); requires significant impairment in personal, family, social, educational, occupational or other important areas.
Functional impairment	Distress or impairment in social, occupational or other important areas due to gaming.	Significant impairment in personal, family, social, educational, occupational or other important areas due to gaming.

2.2. Prevalence across populations

Prevalence estimates are all over the map, partly because studies use different tools and partly because culture matters. The American Psychiatric Association puts the general population estimate at 0.3%-1% [1]. A review of pre-pandemic studies found ranges from 0.2% to 57.5% in general samples and from 2.9% to 14.9% among university students. During the COVID-19 pandemic, a Macau survey found that 7.4% of students met IGD criteria; those cases were more often older, male, long-time players with more weekly play and lower resilience [2]. In a survey of 7,901 Chinese adolescents, the prevalence was 2.27%; the affected group also played more each week and

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reported more negative life events such as maternal rejection or bereavement [3]. The regional differences suggest that access, pressure, and social context all matter.

2.3. Risk and protective factors

Risk for IGD comes from several directions at once. Biologically, people with IGD often show weaker response inhibition, poorer emotion regulation, and prefrontal deficits [4]. On the psychological side, impulsivity, anxiety, depression, fatigue, loneliness, and low self-esteem are common. Social and environmental risks include male gender, limited parental care, family conflict, bullying, and lower academic performance [5-7]. Game features such as variable rewards, dopamine release, and constant social feedback can make excessive play harder to pull back from [8,9]. Supportive parenting and peer support still help.

3. Reward mechanisms and motivational reinforcement

3.1. Neurobiology of reward

Addiction is tied to the brain's reward system. Positive experiences trigger dopamine and endorphins, which help shape mood and motivation; dopamine also makes repeated action more likely [4]. In games, variable ratio reward schedules work because the next reward is never easy to predict. That uncertainty keeps people checking back. fNIRS studies also show stronger hemodynamic responses in the dorsolateral prefrontal cortex, orbitofrontal cortex, and frontal pole during positive events, and weaker responses during negative ones, suggesting that reward and loss are processed unevenly in IGD.

3.2. Variable reinforcement and motivation

Many games lean on variable reinforcement to hold attention. Unpredictable loot drops, randomized achievements, and escalating rewards all feed anticipation [8]. The pattern is simple enough, but it works: players keep going because the next reward might be just around the corner. The downside is that the same setup can make it harder to stop. Over time, work, school, and relationships can slip. Micro-transactions and the social layer around games, including tournaments and offline clubs, can amplify the effect.

3.3. Satisfaction of psychological needs

Self-determination theory argues that intrinsic motivation depends on three basic needs: competence, autonomy, and relatedness [9]. Games can meet those needs by giving players a sense of mastery, room to make choices, and a place to connect with others. One popular explanation notes that games combine progress with skill growth while still letting players feel independent without being left on their own. Multiplayer modes, guilds, and even NPC relationships can add to that sense of belonging. When games meet these needs more fully than offline life does, players often spend more time in them. If real life offers little room for autonomy or competence, games can become the easiest place to get that feeling, which raises the risk of excessive play.

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4. Social identity and belonging

4.1. Family and peer dynamics

Family environment has a strong effect on gaming behavior. In the Chinese adolescent study, gaming disorder was linked to maternal rejection and negative life events such as bereavement or punishment. Other studies point to weak parental supervision, hostile parenting, and low family cohesion. Warmth and consistent monitoring seem to protect against risk. Peer relationships matter too: teens with fewer close friends and more conflict are more vulnerable. In multiplayer games, guilds and online communities can support players, but they can also pull them deeper into play. The Korean logistic regression study even found that attendance at offline game communities and membership in game clubs were risk factors [6].

4.2. Social identity in games

Games also give players a place to build identity. MMOs and competitive games offer clear roles, status, and a steady stream of feedback. Players often attach that identity to achievements, avatars, or community roles, especially when they feel overlooked offline. Once a player's sense of self is tightly tied to an avatar or team, cutting back can feel like losing more than a hobby. Games that leave room for balance and transferable skills may ease that pressure.

5. Weakened impulse control

5.1. Neurobiological deficits

Behavioral addictions and substance addictions share a number of features. Neuroimaging and neuropsychological studies show that people with IGD often have weaker response inhibition, poorer emotion regulation, and reduced prefrontal function [4]. fNIRS work suggests that the dorsolateral and ventrolateral prefrontal cortex respond less strongly during negative game events, with lower oxygenation in both solo and multiplayer play [5]. Since the prefrontal cortex helps with planning, judgment, and stopping impulses, weaker activation there may make urges harder to manage. Stronger responses in reward circuits pull in the opposite direction.

5.2. Cognitive and psychological factors

At the cognitive level, impulsivity and low self-control make resistance harder, and anxiety adds another layer of strain. The MDPI logistic regression study found that both functional and dysfunctional impulsivity, low self-control, and anxiety predicted IGD [6]. Other studies point to depression, social anxiety, fatigue, loneliness, and low self-esteem. Gaming can offer a break from those feelings, but the relief does not last. Negative life events such as parental rejection or bereavement can wear down coping resources, while resilience and self-compassion seem to buffer risk, as seen in the Macau study.

6. Discussion

The evidence here points to gaming addiction as something shaped by neurobiology, psychology, social context, and game design. Unpredictable rewards and achievement systems keep the reward system active and make habits harder to break [4]. When games provide more mastery, choice, and

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connection than daily life, it is easy to see why engagement grows. People with impulsivity, anxiety, and weak self-control are more vulnerable. Neuroimaging studies also show stronger reward sensitivity and weaker loss responses in the prefrontal cortex, which looks a lot like patterns seen in substance addictions [4,5]. Social isolation, a difficult family environment, and negative life events can make that picture worse. Interventions, then, need to work on several levels at once: self-control and coping skills, real-world opportunities for autonomy and connection, and game design that does not lean on exploitative rewards.

7. Conclusion

Internet gaming disorder represents a serious behavioral addiction for a minority of players. Diagnostic frameworks require impaired control over gaming, prioritization of gaming and continuation despite harm. Prevalence varies widely, with estimates ranging from 0.3%-1% of the general population to 7.4% among Macau university students and 2.27% among Chinese adolescents [2,3]. Research shows that addiction arises from neurobiological vulnerability, psychological traits, social environment and game design. Variable reinforcement schedules stimulate dopamine and create strong habits; games satisfy basic psychological needs and can provide identity and belonging; individuals with impulsivity, anxiety or low selfcontrol are more at risk; and adverse family and social contexts amplify vulnerability [4]. Neuroimaging studies reveal that IGD involves heightened reward sensitivity and reduced loss sensitivity in the prefrontal cortex, resembling substance addictions [4,5]. Recognizing these mechanisms is crucial for developing effective prevention and treatment. Evidencebased interventions can reduce symptoms [10]. Policymakers and game designers should collaborate to minimize harm by discouraging exploitative reward systems, providing playtime feedback and promoting balanced ingame economies. Ultimately, creating environments that support competence, autonomy and relatedness in real life may be the most sustainable strategy to prevent gaming addiction.

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