

# Ripple Effects of Electronic Games and Evolution of Electronic Game Platforms

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## ABSTRACT

*This paper discusses an academic study on electronic games and their incredibly vast and rapid growth over the years. It specifically addresses the evolution of electronic games from the 1960s to today, the ripple effects of electronic games, and the development of electronic game platforms. In terms of scope, the study first describes the ripple effects of the emergence of electronic games in chronological order and from the “immersion” and “convergence” perspectives, and then explores the evolution of electronic game platforms such as arcade machines, video consoles, personal computers, and mobile game devices.*

**Keywords:** *Electronic Game History, Immersion, Convergence, Game Platform.*

## 1. INTRODUCTION

The most notable change taking place since our society’s entry into an information-based paradigm is the transition from an analogue structure to a digital one, as catalyzed by the advent and advancement of digital technologies. Society evolved from an agrarian to an industrialized structure and has recently undergone yet another transformation as digital technologies continue to advance. In particular, quality of life became increasingly more important across the entire society, giving rise to entertainment industries suitable to the new digital environment. One of these industries is the electronic game industry, which has grown steadily over the years and transformed into a high-value-added industry on the strength of advancements in Internet and networking technologies. To put this into perspective, the scale of the electronic game market for 2008 in South Korea alone was ₩5.605 trillion. Worldwide, the market scale reached \$101,910,000,000[1]. The media and related research bodies have criticized electronic games, however, arguing that their immersive nature either directly or indirectly causes game addiction and related problems.

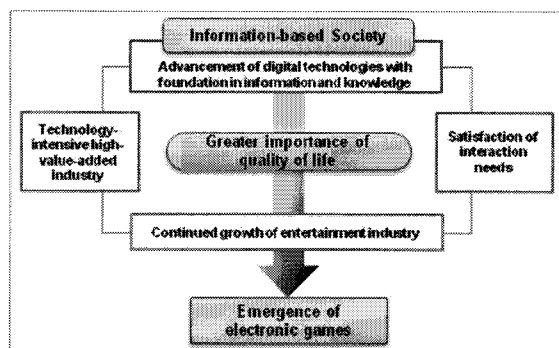


Fig. 1. Background of the emergence of electronic games[2].

In response to these criticisms, some studies advocate critical research on and analysis of the causes of game addiction and

the development of positive functions in terms of the approach to electronic games, rather than taking a more forcible approach to game addiction. In fact, electronic game developers are now focusing on positive functions beyond mere profitability and entertainment benefits in their new products. Electronic games are now truly a part of the entertainment culture of the 21st century, and their infrastructure is expected to continually expand[3]. In other words, electronic games warrant more detailed and in-depth research and study now more than ever.

This paper describes an academic study on electronic games and their incredibly vast and rapid growth over the years. Specifically, the paper explains the evolution of electronic games from the 1960s to today, describes the ripple effects of electronic games, and explores the development of electronic game platforms. In terms of scope, the study first describes in detail the ripple effects of the emergence of electronic games in chronological order and from the “immersion” and “convergence” perspectives.

In the second part of this paper, the transformation of electronic game platforms from a simplified chip-based hardware architecture to today’s specialized and advanced forms is explored. The section specifically discusses ROM (Read-Only Memory)-based arcade machines, residential video consoles, personal computers and online games, and mobile game devices. The author wishes that the information contained in this paper would be used as reference material in the academic development of electronic games and as educational material for use in electronic game education.

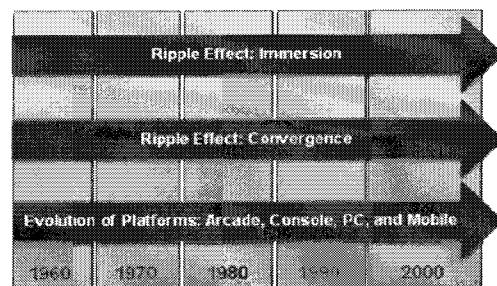


Fig. 2. Study scope and process.

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Manuscript received Nov. 26, 2009 ; accepted Jan. 20, 2010

2. MAIN BODY

2.1 Ripple Effects of Electronic Games

In 1958, Willy Higginbotham of Brookhaven National Lab in New York, USA developed the world's first electronic video game: an oscilloscope-based tennis game[4]. Then in 1962, MIT's Steve Russell developed *Spacewar* using a numerical calculation computer[5]. These two games emerged not as products, but as two personal "creations" that marked the beginning of modern electronic games and their tremendous growth. Specifically, electronic games, in the process of their evolution, had the following ripple effects.

2.1.1 A Psychological Ripple Effect Known as 'Immersion'

The dictionary defines *immersion* as 'The condition of being immersed.' One of the foremost academics in the field of immersion psychology is Mihaly Csikszentmihalyi, the architect of the notion of *flow*. Csikszentmihalyi defines *flow* as "a sense that one's skills are adequate to cope with the challenges at hand in a goal-directed, rule-bound action system that provides clear clues as to how one is performing. Concentration is so intense that there is no attention left over to think about anything irrelevant or to worry about problems. Self-consciousness disappears, and the sense of time becomes distorted. An activity that produces such experiences is so gratifying that people are willing to do it for its own sake, with little concern for what they will get out of it, even when it is difficult or dangerous[6]."

During the early stages of the formation of the electronic game industry, electronic games added interactivity to the already immersive conventional games and played a pivotal role in forming an immersive game culture. Prior to the advent of electronic games, non-computerized games were centered on work and were designed to be entertaining and/or to strengthen cooperation and friendships. As such, games were means of developing and strengthening friendships during the agrarian era, when religious ceremonies, bountiful harvests, and fecundity were some of the highest values of the communities. When society entered the industrial era, games became a part of rest and leisure, helping people relieve stress and recharge.

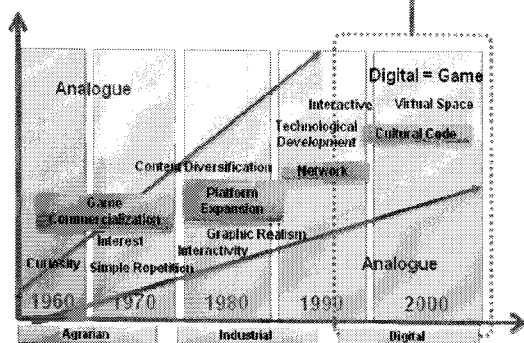
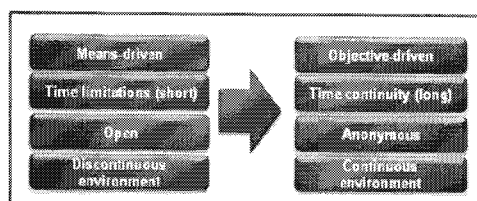


Fig. 3. Formation of a psychological ripple effect known as "immersion."

Up to such time, games were largely considered instrumental activities. Meanwhile, digital games added competition, accomplishment, satisfaction, challenge, and other new objectives to conventional games. In other words, electronic games allowed the player to experience immersion and offered even greater immersion experiences as the games themselves became more advanced.

As shown in Fig. 3, games started out as simple and repetitive means of stimulation. Over the years, electronic games gradually became commercialized, more varieties of game genres and platforms became available, and game and platform technologies continued to reach new heights and provided players with an abundant source of immersive entertainment. The advancements in networking technologies that ensued allowed players to enjoy games in virtual environments without the time limitations associated with the games that preceded them. Furthermore, hardware developments personalized the game playing experience and allowed the player to join cyber communities where they could meet and play with other players. One of the main appeals of cyberspace was how it allowed players to achieve surreal satisfaction by doing and experiencing things that are possible only in virtual worlds and through personalized characters that allowed the players to maintain their anonymity, which further added to the immersive psychological effects of electronic games on players.

2.1.2 Convergence throughout Evolution

This section discusses the evolution of electronic game genres, the correlations of the electronic game industry with other industries, and the convergent nature of online electronic game contents.

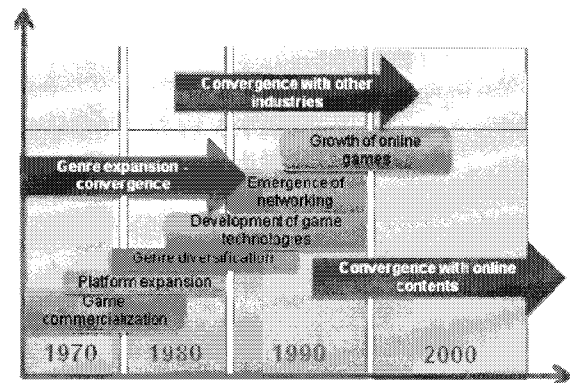


Fig. 4. Convergence throughout Evolution of Electronic Games

Key 1: Changes in Game Genres

The oldest genre in electronic games is the shooting genre, which emerged with the commercialization of arcade games in the 1970s, as represented by Pong, Breakout, and Space Invader. Other genres were quickly introduced thereafter, including racing, sports, and flight simulation.

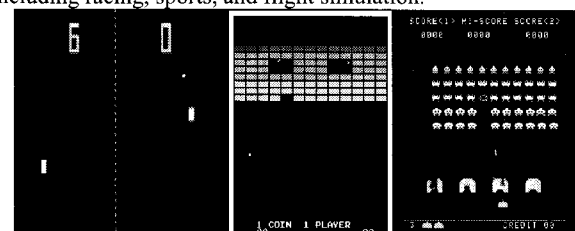


Fig. 5. Pong (left), Breakout (center), and Space Invader (right). The 1980s saw the arrival of the action genre, which

included games that allowed the player to take control of virtual characters. In addition, the video game console industry grew and brought arcade game genres to homes, which paved the way for the introduction and spread of the adventure, RPG (Role-Playing Game), and FPS (First-Person Shooter) genres.

In the 1990s, arcade and console games continued their steady growth while computer technologies drastically advanced and more and more households acquired personal computers. As such, publishers started developing electronic games for personal computers, focusing mainly on simulation, RPG, and FPS titles.

With the arrival of the new millennium, electronic games did not diversify so much as to offer entirely new genre concepts, but rather started to offer mixed genres that combined aspects of two or more conventional genres. The proliferation of the Internet, in particular, led to games that modified and/or expanded upon games of conventional genres and leveraged the multiple-user-connectivity aspect of the Internet, which led to the emergence of new electronic game genres that allowed players to interact with other players in dynamic and powerful environments. The availability of platforms, technological advancements, and the diversity of subject matter slowed the introduction of completely new genres and resulted instead in many new mixed genre games that enabled new immersion experiences for the player. Even today, publishers are taking games from conventional genres and imbuing new formats and new subject matters into them through superior planning to introduce entirely new types of games. Continued advancements in networking technologies, platforms, and physical interfacing are likely to lead to the introduction of never-before-seen genres and the continued convergence of existing genres.

### Key2: Convergence with Other Industries

The electronic game industry requires little initial investment, but offers quick turnaround to mass production and consequently good potential for high returns on investment. This industry has always had close ties with other industries and grew along with them. Initial industry-to-industry convergence involved the development of new game contents and products in conjunction with the toy, animation, film, publication, and cartoon industries. Two of the most definitive examples of such convergence are Mario Bros. (Nintendo) and Sonic the Hedgehog (Sega) from the 1980s[7]. Due to the unlimited range of product development possible with electronic games, this type of industry-to-industry convergence still continues to this day, under the concept of OSMU (One Source, Multiple Users).

In addition, advanced electronic game development technologies offer functional benefits when combined with technologies from other industries. An example of this form of convergence, known as OSMS (One Source, Multiple Services), can be found in the military's use of flight simulator technologies from the electronic game industry for its virtual training programs. Specifically, the military exploited the immersive nature of electronic games to increase the effectiveness of its soldier training. An interesting current development in the electronic game industry is the continuing growth of the functional game segment, which has applications ranging from macro-categories such as the government, industry, and education to micro-categories such as market segments, individual corporations, and special-purpose organizations[8].

### Key 3: Convergence with Online Contents

For electronic games, convergence with online contents

began with the introduction of modems for personal computers. With today's infinitely faster and more complex networking environment, electronic games are now converging with an entirely new class of online contents. MUD (Multi-User Dungeon) was a concept that was put into practice in the mid-1990s to leverage multiple user connectivity. The concept converged with online chatting and gave birth to text-based online games. In Korea, Hitel, Chollian, and other ISPs started to service games such as Ttang (Mari Telecom) and Jurassic Park (PC Van). As MUD evolved into MUG (Multi-User Graphics), the Korean public was introduced to games such as Empire of Wind (Nexon) and Lineage (NC Soft)[9]. Online PC games then merged with instant messaging, game-related blogs, and game-related online communities and are now starting to offer digital music through new, music-related games (including dancing). The latest development in online PC gaming is the convergence of online games with SNSs (Social Network Services). These latest electronic games are combining UCCs (User-Created Contents) and are already evolving into UCGs (User-Created Games), which also contain advertisements that are directly built into the games themselves.

Table 1. Forms of Online Content Convergence.

Online Content	Convergence Games
Chatting	MUD and MUG games
Community (Instant Messenger, blogs, cafes)	MMORPG, casual, and other types of online games
Digital music	Online Music and Dance Games
UCC	Character-customizing Games Map, GUI-created Games User-created Games
SNS	SNS-linked Games Xbox 360 'NXE' / PS3 'HOME'
Advertising	In-game Advertisements

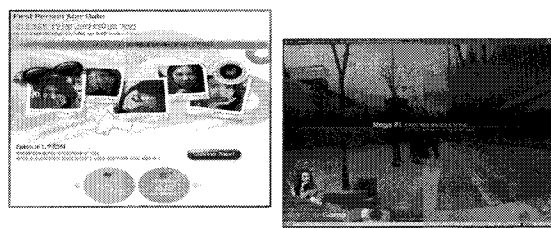


Fig. 6. Advertisements in games[10].

## 2.2 Platforms and Their Evolution

The commercialization of the electronic game industry started with arcade machines, which begot video consoles, personal computers, and mobile devices. Personal computers and online games, in particular, immensely grew along with advancements in networking technologies, and some of today's video consoles are now supporting Internet connectivity and online game playing. Mobile gaming devices, on the other hand, include mobile phones, PMPs, and other handheld devices that download contents from the web.

### 2.2.1 From Pong to Interactivity: Arcade Machines

Computer Space was introduced in the 1970s as the world's first commercial electronic game. Pong followed soon

thereafter, and became a major hit that led to the commercialization of the arcade platform and served as the basic form of all arcade machines that followed[11].

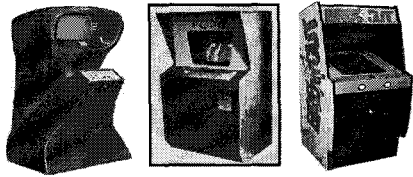


Fig. 7. Computer Space (left), Pong (center), Breakout (right).

Pong was, in fact, the first-ever commercially successful electronic game. The game had extremely simple controls and yet was massively popular. An arcade game called Space Invader was then introduced from Japan. A shooting game that featured a pattern-recognition AI, Space Invader is the genesis of all modern shooting games, and in it, the player interacted by shooting down attacking UFOs[12], [13].

In the 1980s, personified characters started to be introduced through games such as Pac-Man, Donkey Kong, and Mario Bros. Along with diversified game subject matters came the replacement of simple graphics and sounds with color graphics and advanced sound effects.

The next major development in arcade machines was the arrival of a game called Man vs. Man in the 1990s. This game featured powerful game elements known as competition and challenge, and was indeed the first arcade game to really capture the player's interest on a far longer basis than the rather simple games that preceded it. Then came arcade machines, with which players interfaced using their entire body. One of the most notable examples of these games is D.D.R. (Dance Dance Revolution), which became immensely popular with people of all ages in Korea. Its feature that allowed players to move and use their bodies to interact with the game, without restrictions, became an important interactive element. The bodily interaction, combined with the stimulation of all five senses, also meant very strong immersion experiences for the player.

	Pong	Space Invader	Donkey Kong / Pac-Man	Tetris	Street Fighter	D.D.R.	Driving Simulators
Immersion	Simple and repetitive	Objective based and simple destruction	Objective based and problem-solving	Puzzle	Man vs Man, Competition and tension	Interactive	Interactive
Interaction	Up and down	Move, shoot, and evade	Move, items, jump, etc.	Geometric relationship	Reaction, attack, and character mastery	Rhythmic reaction	Virtual experience using physical apparatus
Stimulus	Visual	Visual & Auditory	Visual, Auditory, and Perception	Visual, Auditory and Perception	Visual, Auditory and Perception	Visual, Auditory, and Perception	Visual, Auditory, and Touch

Fig. 8. Evolution of arcade games.

**2.2.2 From Cartridges to DVDs and to the Web: Evolution of Video Consoles**

The first video console in the world was Magnavox Odyssey, which was introduced in the 1970s[14]. In addition, the success of Pong in the arcade format led to a home version that bore the same name.

These early home video consoles featured controllers and a

cartridge slot to insert game cartridges in. The video console became more sophisticated as time passed, and featured microprocessors and offered a wider range of games to choose from[15].

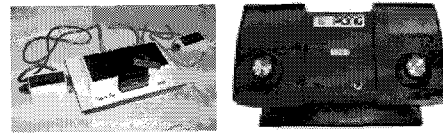


Fig. 9. Magnavox Odyssey (left) and Pong Console (right).

console in the 1980s was Famicom. This console utilized ROM cartridges that allowed the user to exchange his or her games with others. In essence, Famicom was the first example of a video console as a viable and sustainable commercial enterprise. Succeeding after Famicom's immense success was Super Famicom. First introduced in the 1990s, Super Famicom also enjoyed much commercial success[16].



Fig. 10. Famicom (left) and Super Famicom (right).

CD-ROMs eventually replaced ROM cartridges. They addressed the speed and capacity limitations of the latter and allowed more diverse game contents. In addition, CD-ROM games were significantly cheaper and easier to mass-produce than ROM cartridges. Consoles such as Sega Saturn and Sony PlayStation pioneered the use of CD-ROMs, a move that was soon followed by virtually all other home video console makers in the industry.

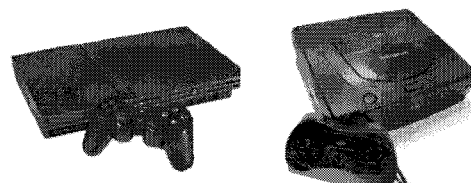


Fig. 11. Sony PlayStation (left) and Sega Saturn (right).

In the 2000s, video consoles underwent rapid CPU, graphic processor, and memory upgrades and began to run DVD games. Soon thereafter, video console makers started implementing online strategies for the consoles, which made it possible for the user to directly purchase and download game data from the Web and without having to load a hard copy into the console. Xbox 360 (Microsoft) made it mandatory for users to subscribe to high-speed Internet services to present a uniform online game playing experience, whereas PS3 (Sony) and Wii (Nintendo) came up with a dial-up modem to allow players to enjoy a wider variety of game services[17]. One of the more recent developments with video consoles is the promotion of networks that are unique to individual consoles. The expanded game experiences that console makers will be able to provide through this feature are expected to increase in importance in the future.

In other words, the networking features of video consoles function as sales channels for game titles, sharing points for individual users and the games they have developed, and access

points to virtual worlds such as Second Life.

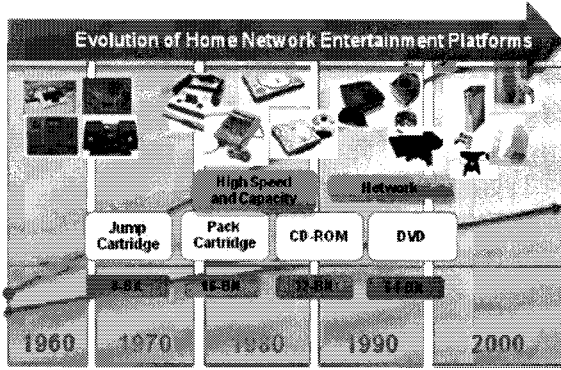


Fig. 12. Evolution of Video Consoles.

In the near future, video consoles are expected to develop into new “Home Network Entertainment Platforms,” a new interactive medium.

**2.2.3 Workstations to Online Gaming: Evolution of Personal Computers**

The first electronic game for the personal computer platform was 1972’s Hunt the Wumpus. Hunt the Wumpus, a text-based game, was written by Gregory Yob of Dartmouth campus of University of Massachusetts[18]. This was the beginning of electronic games for numerical analysis computers. The game itself came in a cassette format, which the player could insert into the computer’s cassette slot. Advancements in computer hardware components--namely, the development of 256-color VGA graphic cards and advanced sound cards - resulted in more dynamic and interactive game playing. In particular, the development of the CD-ROM technology meant improved cross-platform software compatibility and software productivity. A plethora of new PC games from a wide variety of genres was developed, and continued advancements in graphics processing and storage, as well as in data processing technologies, led to rapid progress in adventure, RPG, and simulation genres. Then the next big step came in the form of online games.



Fig. 13. Ultima Online screenshot.

With the introduction of Ultima Online, a game that allowed multiple players to role-play in a virtual online environment, an era of online multiplayer games began. Online multiplayer environments eventually developed into MMORPGs (Massively Multi-player Online RPGs) and paved the way for various sustainable online games.

In the near future, online PC gaming is expected to advance into a media point that would enable users to experience games and various other online contents.

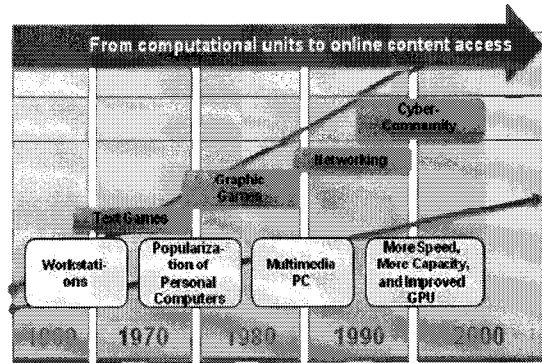


Fig. 14. Evolution of personal computer gaming.

**2.2.4 From Simple Mobility to Personalized Entertainment Centers: Evolution of Mobile Game Devices**

The world’s first mobile game was Auto Racer by Mattel Electronics (1976). This game, however, was not fully electronic. The title of the world’s first fully electronic mobile game therefore goes to Microvision (Milton Bradley, 1978), which utilized cartridges to load different games.[19]

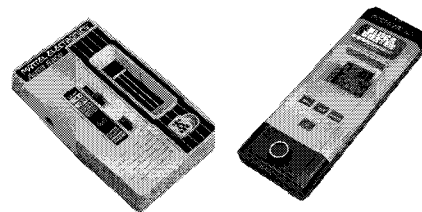


Fig. 15. Early mobile games [Auto Racer (left) and Microvision (right)].

Handheld game consoles were designed to address the demand for game playing anytime and anywhere in a truly portable and mobile form.

Early games were limited by hardware and therefore mostly simple and repetitive programs. Despite this, however, early mobile consoles and games were at the top of all children’s wish lists. The real growth of mobile game consoles was made possible through the porting of arcade games, which were enjoying ever-increasing variety in terms of subject matter and genre.

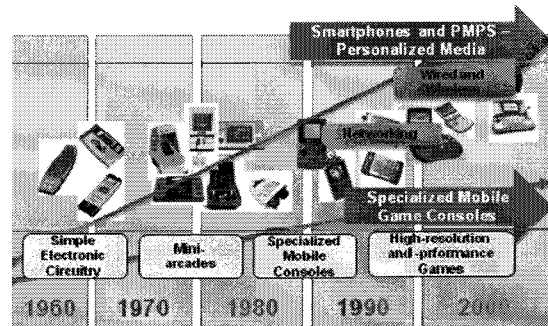


Fig. 16. Evolution of mobile game consoles.

In addition, more and more titles are being written for devices such as mobile phones, which is paving the way for the development of games that utilize the improving performance of mobile devices and satisfy consumer demand for greater entertainment functionality.

Along with continuing advancements in communications, improvements in embedded networking technologies, and increasing demand for mobility, mobile devices such as PDAs, PMPs, mobile phones, and handheld game consoles are fast growing as ideal platforms for the upcoming "personalized media" era.

### 3. CONCLUSION

This study explored the ripple effects of electronic games over the course of their evolution and the evolution of electronic game platforms. This study revealed that today's electronic games are more than simple sources of entertainment and are instead developing into an entire new digital segment referred to as "interactive media." In other words, electronic games, during their half-century-long history, converged with other industries and took up an important place in today's entertainment culture. Electronic games are among the key factors in the arrival of the digital entertainment culture, providing high degrees of immersive entertainment for players. Furthermore, the hardware platforms of electronic games are slated to be transformed into integrated and comprehensive networked entertainment systems that would feature highly interactive control interfaces maximizing the use of ergonomic and sensory interfacing.

In the very near future, specialized industries are expected to be formed around sustainable game contents, realistic graphic rendering, advanced sound processing, and interactive interfacing to provide immersive game experiences that stimulate all five senses. To ensure the systematic advancement of electronic games, research on the various characteristics of electronic games must be completed and the results thereof utilized to propose new game designs with a more positive approach. The author of this paper intends to continue analyzing electronic games from a variety of angles and to present the findings and conclusions from such analysis for the betterment of electronic game development.

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