Video Games: History, Technology, Industry, and Research Agendas

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I. Overview

This paper explores multiple aspects of the video game field, including a history of the medium's development, influential academic perspectives, ongoing technology and industry trends, and a survey of current research agendas. It is intended to provide a general background for scholars and students who are exploring the field academically and who want to understand various aspects of this media technology and primary trends in related research.

The growth of the video game industry is often understood in terms of video game device development. Gaming devices are usually divided into: 1) gaming-oriented devices such as arcade games and stationary/portable gaming consoles, and 2) integrated, multi-purpose devices such as PCs, smart devices, and recent wearable technologies. Traditionally, each device possessed its own characteristics; consoles were optimized for playing high quality video games, and portable consoles or handheld devices enabled ubiquitous gaming. PCs connected to the Internet allowed gamers all around the world to play together in virtual space, and smart devices have provided new gaming experiences with their unique functions such as GPS, gyroscope, and Near Field Communication (NFC), which expanded the base of gamers to most smartphone/tablet users.

However, the distinct characteristics of each gaming device are getting more and more blurred. Consoles now allow access to online gaming environments and handheld

devices have expanded their displays to PC monitors and TV screens. Additional apparatus such as attachable gamepads and augmented reality goggles are added to smartphones and tablets to offer advanced gaming experiences. Smart devices are also being used as secondary screens to support console gaming. Finally, recent wearable digital devices such as Google Glass and Oculus Rift are expected to combine with these existing gaming devices to provide enhanced gaming experiences.

In addition, recent cloud gaming services are even expected to minimize the dependency of video gaming on particular gaming devices. Various companies, including CiiNOW, Ubitus, Gaikai, and OnLive, began to provide cloud gaming services that enable gamers to play high quality games on a variety of platforms. Console maker Sony also revealed it is preparing a cloud gaming service for its current console, PlayStation 4.

The video game industry is one of the most dramatically growing markets in this digital age. According to industry research company Gartner, the global video game market is expected to reach $111 billion in 2015. As of 2013, the video game console market makes up the biggest part of the total video game market with $44 billion (47.5%) and is expected to grow consistently with the release of the next generation consoles from Sony, Microsoft, and Nintendo. Meanwhile, the fastest-growing market is the mobile game industry, with a projected 29.8% growth rate in 2014 and 28.4% growth rate in 2015. In 2015, the mobile game market is expected to be the second biggest market, worth $22 billion (Gartner, 2013).

Market research groups Newzoo and GlobalCollect predict that MMOs will be the second fastest growing market worldwide, growing over 14% annually (GlobalCollect, 2013). The handheld video game market is the only segment which is expected to decline, and the growth of mobile game industry is cited as a major reason (Gartner, 2013).

Video gamers are often classified according to the number of hours they devote to gaming, their means of game acquisition, their choice of device, and the types of games played. These types—which may overlap--include core gamers who play and buy games most frequently; digital gamers who also devote many hours a week but acquire games by digital means; mobile gamers playing via mobile devices; family gamers playing with other family members; and those who mainly play casual games. Among them, mobile gamers (22%) and core gamers (21%) make up the largest percentage, and the mobile gamer category is growing the most dramatically (NPD, 2012). According to annual reports by the Entertainment Software Association (ESA), two demographic categories have changed significantly during the past five years in the US, which is the largest video game market. Firstly, the average age of US video gamers has lowered from 35 in 2008 to 30 in 2013, and the average age of the most frequent game purchasers also has lowered from 40 to 35. Secondly, the percentage of female gamers has increased steadily from 40% in 2008 to 45% of the market in 2013. Market research by the ESA reflects that US consumers buy games of different genres for different devices. Gamers mainly bought action games (22.3%), shooter

games (21.2%), and sport games (15.3%) for their consoles, while they bought more role-playing games (28%), casual games (26.7%), and strategy games (24.9%) for their PCs. This seems to reflect the trend that gamers play more hardcore or blockbuster games via consoles and online games via PCs. Many mobile gamers tend to play simple and easy games such as puzzle/board games/card games (35%) and casual/social games (35%). Overall, 45% of smartphone users and 69% of tablet users play games with their smart devices (Mitchell, 2013).

The video game software industry includes four types of developers: first party, second party, third party, and independent developers. First party developers work in-house for gaming platform companies like Microsoft and Sony, publishing big titles and franchises. Second party developers are either independent studios producing exclusive games for contracted platforms, or studios partially or wholly owned by a platform holder, as subsidiaries. Third party developers, such as Electronic Arts and Sega, are relatively independent from game platforms. Independent developers usually are small companies publishing games with low development and distribution costs. This group is growing in accordance with the spread of apps for smartphones, tablets, and social media (Kline, 2012).

Though all four types of developers publish numerous video games, the top 20 games accounted for 41% of the total US game sales in 2012, nearly double the market share of a decade earlier. At the same time, the number of game titles released in US stores in 2012 was

only half that of 2008. This trend is driven by major publishers pursuing the strategy of making fewer top quality titles, and this causes polarization between indie developers shifting toward smartphones and tablets and a small number of big publishers focusing on blockbuster console games (Wingfield, 2013).

While this describes trends in the US video game industry—the largest in the world--understanding the various differences between regional markets around the globe is also of key importance, and these lesser markets have often been ignored. Study of regional industry and consumer activity may reveal meaningful industry trends unique to different regions as well as an overall picture of the growing global market. The largest game developers by country are the United States, Japan, Canada, and the United Kingdom (ESA, 2013). Gamers in top videogame markets have shown distinct platform preferences by country: Players in the UK are more likely to play on traditional consoles while players in France favor portable consoles, and German players prefer computer-based gaming. Gamers in the United States are more likely to favor mobile or tablet gaming (Peterson, 2013). Japanese gamers, who make up one of the world's biggest markets, also show a preference for particular content; consumers in Japan prefer family oriented fantasy games rather than those with explicit sexuality or violence like the Grand Theft Auto series, a bestseller in the US (Hasegawa, 2013). These are only a few examples of how videogame usage patterns and consumer preferences vary by region.

The Chinese market, which is primarily digital, is projected to grow over 10% a year, so that by 2016 Asia may account for the majority of mobile and online game sales. Asia is currently the largest massively multiplayer online (MMO) game market and is responsible for nearly two-thirds of global MMO revenues (GlobalCollect, 2013). The global game industry is also consolidating; 2012 witnessed the most mergers and acquisitions, according to analysts, with Asian companies accounting for many of the largest acquisitions (Peterson, 2013).

The video game industry in Portugal is still developing. Until a couple of years ago, Portugal was one of the most noticeably emerging video game markets. The Portuguese video game market currently faces a crisis due to the effects of the recession and reduced market values through 2013. However, the fact that video games are successfully positioning as family entertainment is expected to bring opportunities to the national video game industry (Batchelor, 2013). As of 2012, 31% of the Portuguese online population was playing video games at least monthly, and 43% of these gamers were female. A recent study shows that Portuguese gamers play most frequently via PCs (33%)--more than with consoles (21%) or mobile devices (20%) (ISFE, 2012).

II. Video Game History

The video game industry has experienced several watershed moments: The shift from pinball to arcade games, the shift from arcade games to console games, the later advent of massively multiplayer online games, or MMOGs, the emergence of social games, and the adoption of mobile technologies (Zackariasson & Wilson, 2010; Chou, 2013). Each major shift has influenced the whole game sphere in a variety of ways. Recent gaming technologies such as cloud gaming and virtual reality are expected to drive more changes in the near future.

Although there were earlier arcade games such as *Computer Space*, Atari's 1972 *Pong* was the first arcade game that attracted public attention. While *Pong* played a groundbreaking role as the first commercially successful video game, other blockbuster arcade games such as *Space Invaders* (1978), *Defender* (1980), and *Pac-man* (1980) led the growth of the arcade video game industry. These games heralded a new era of video games by replacing analog games such as pinball machines.

In the same year *Pong* was released, Magnavox launched the first video game console, Odyssey. However, it took more than 10 years for the console games to achieve mainstream popularity. Nintendo initiated the console boom by launching two influential consoles: Famicom in 1985 and Super Famicom in 1990. Nintendo's early titles such as the Super Mario series have evolved into huge franchises that span multiple genres. Sony launched the PlayStation in 1994 and Microsoft introduced the Xbox in 2001, creating the

present landscape of three major console makers.

With the spread of personal computers in the mid-80s, PC games began to attract notice. Though they were considered to be a factor in the console game market crash in the early 80s, PC games did not become truly popular until the 90s (Ryu, 2013). With the emergence of the Internet, PC online games began to develop. The first generation of online games was text-based and *Neverwinter Nights*, the first online game with graphics, was released in 1991. In the past several years, the PC-based online game market increased dramatically with mega hits such as *World of Warcraft*, a MMOG, and *League of Legends,* a multiplayer online battle arena game. By 2014, however, the MMOG market was observed to be stagnating, and WoW, once a leading game, has lost about 5 million subscribers since its peak of 12 million in 2010 (Cameron, 2014.)

Mobile game history began when a phone manufacturer, Hagenuk, installed the first mobile game, *Tetris*, in their mobile phones in 1994. However, the first mobile game that received significant attention was Nokia's *Snake*. The mobile game market expanded explosively with the advent of the Apple App Store in 2008. The development of smartphone technologies and the emergence of the online application stores allowed numerous mobile phone users to experience these games. This mobile trend is also supported by the spread of tablets. As smart device technology advances, the mobile game industry is likely to grow with it.

III. Academic Approaches to Video Games

1) Game Studies

Traditionally, the field of game studies has been divided into two theoretical perspectives, narratology and ludology. While narratologists regard video games as a kind of storytelling media, ludologists argue that video games have to be understood according to the medium's unique characteristics, as systems of rules. Influential narratologist Brenda Laurel (1991) interprets video games with an evolutionary view, arguing that video games exist as an extension of movies, which are in turn extensions of novels. In *Hamlet on the Holodeck*, Janet Murray (1997) defines video games as cyber drama. For the narratologists in the traditionalist school, the Aristotelian concept of drama is an essential element; they regard video games as nonlinear narratives derived from existing narratives. These narratologists emphasize interactivity as the most distinctive element in game narratives and argue that video games are the subgenres of existing forms such as movies and novels (Laurel, 1991; Manovich, 2001; Mateas, 2001; Murray, 1997). Meanwhile, scholars in the expansionist school argue that the features of narrative change according to sociocultural contexts, and the game narrative does not have to follow the grammar of other narrative genres; instead, they emphasize the nonlinear structure of video games (Jennings, 1996; Landow, 1997).

In contrast to the perspective of narratology, proponents of ludology argue that video games have to be analyzed just as they are—games to be played. Ludologists including Espen

Aarseth (1997), Gonzalo Fransca (2003), and Jesper Juul (2001) believe that simulation, which is one of the most important characteristics of video games, will be neglected if scholars only focus on storytelling structure. While narratologists' ideas are based on Aristotelian concepts, ludologists develop their ideas from the concept of "play." Influential scholars Johan Huizinga (1949) and Roger Caillois (2001) define 'play' as something separated from reality, unproductive and controlled by rules.

Ludologists such as Chris Crawford (2012) and Katie Salen and Eric Zimmerman (2004) focus on video games' characteristics of interaction, conflict, and rules. One of the most eminent ludologists, Juul (2011), describes four essential elements of video games: rules, variable and quantifiable outcomes, players' efforts, and negotiable consequences. Ludologists maintain that the simulation in video games encourages gamers to behave according to particular rules, while the representation in narrative causes emotional stimulus in readers and audiences (Aarseth, 1997; Fransca, 2003; Juul, 2004).

Though these two schools analyze video games from different points of view, scholars in each of these camps acknowledge the importance of the opposing school's ideas. Narratologist Murray (2004) recognizes the significance of simulation in games such as *The Sims* while Fransca (2003) accepts the importance of narrative in video games. Meanwhile, scholars including Henry Jenkins (2004) have embraced some aspects of both of these perspectives. While some members of these schools agree on the importance of both narrative

and simulation, a theoretical framework integrating both of the perspectives is not yet available.

2) Video Game Taxonomy

While there is no standard academic agreement in classifying video games, there are three frequently used criteria: 1) platforms, 2) genres, and 3) purposes. Traditionally, scholars have often classified video games according to platforms such as hardware and gaming devices. In this regard, video games are divided into arcade games, console games, PC games, and handheld device games. With the development of the Internet and mobile technologies, online and mobile games have been added as categories. Specific subtypes such as massively multiplayer online (MMO) games were later derived from online games. Recently, various online and mobile service providers including social network sites are offering their own game platform services and this will further complicate classification.

Classifying video games according to genres is as complex as classifying by platforms. Game genres include action, adventure, role-playing, simulation, strategy, and casual games. There are numerous subgenres, and these genres and subgenres frequently overlap and converge. Many recognized game categories are a combination of a platform and a genre, such as the mobile social game or the MMPORG (Massively Multiplayer Online Role Playing Game). Additionally, games may be categorized by their purposes, such as

educational games, serious games, and exergames.

Consoles have recently begun to offer online gaming abilities. In addition, cloud gaming services such as Gaikai and OnLive provide external gaming servers that allow gamers to transcend the limitations of gaming devices. Gaming platforms may become decoupled from physical devices and thus, the categorization of games according to platform needs to be reevaluated. Moreover, traditional video game genres are changing and being adapted as social games and augmented reality games become popular. Academically rigorous studies on video games must consider the ambiguous and shifting nature of these categories and definitions.

IV. Current Status

1) Arcade Games

The arcade game industry has faced a continuous decline since its last resurgence in the early 1990s; this is credited to the rising popularity of the home-based video game console and PC games. Though the arcade games led the global game industry in the early stages, they lost the lead to the console games in 2007, and lost second place to online games in 2012 in the global game industry (DFC, 2011; Enterbrain, 2012; JOGA, 2012; Playmeter, 2012; PWC, 2012). The future of arcade games is unpromising but they continue to occupy a

niche in the market.

2) Console Games

The year 2013 was a significant year for the console industry. The spread of mobile games, which is linked to rising smartphone adoption and the growth of PC online game, particularly in East Asian countries, is becoming a major threat to the console makers (Edwards & Amano, 2013; Leather, 2013). In the meanwhile, the three biggest console manufacturers--Nintendo, Sony, and Microsoft--have launched their next generation devices. At the end of 2012, Nintendo released Wii U, the new generation of the Wii console originally launched in 2006. The Wii U features a game controller with a touchscreen, offering the player a supportive secondary screen. Sony and Microsoft released their new consoles in late 2013, heightening competitive tension in the market.

Xbox One positions itself as a home-entertainment hub that surpasses the mere role of a gaming device. Kinect—a motion detection technology first released in the Xbox 360 in 2011--is one of the most distinctive features of the console. The Xbox One also facilitates cloud gaming but Microsoft's initial policy of requiring daily online Internet connection caused many gamers to complain, and the company retracted this policy in June 2013. Microsoft's Digital Rights Management (DRM) policies, which would have restricted the resale market for disc-based games on the Xbox One, also attracted controversy in 2013 and

were subsequently revised after consumers' protests (Warr, 2013).

Meanwhile, Sony has emphasized the role of the PlayStation 4 as a gaming device. The company's existing cloud gaming service, All Access Play, has drawn much attention from gamers, allowing them to play the PS3's exclusive games via cloud gaming. Gamers also may be able to play the PS4's games with their handheld device, PlayStation Vita, through the All Access Play service. In January 2014, Sony reported that between the PS4's release in November 2013 and the end of the year, 4.2 million units were sold, substantially more than the 3 million Xbox One units reported sold by Microsoft.[1] The console market is expected to change, however, as the Xbox One is released in more territories; as of the start of 2014, the PS4 was available in 48 territories around the world, compared to Microsoft's 13 territories. Also, neither device had yet entered the Japanese market (Tassi, 2014).

3) PC Standalone Games

PC offline games constitute a shrinking market that is expected to decrease from $534 million in 2011 to $434 million in 2016 (PWC, 2012). The PC game market has also been the smallest in the overall video game industry since 2008, increasingly falling behind console, online, and wireless games (PWC, 2012). The major reasons for this market trend include gamers' transition to non-PC platforms, increasing adoption of digital distribution,

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[1] The PS4 was released before the Xbox One, giving the former an extra week of sales.

and piracy. However, in Latin America the PC gaming market is anticipated to increase by approximately 3% on average through 2014, since the poor Internet infrastructure in many areas makes online gaming difficult and the economic conditions make expensive consoles out of reach for many players (PWC, 2012).

4) Online Games

The online game industry is one of the most rapidly growing markets in the video game sphere. The online gaming market is expected to increase by an average of 15.7% between 2009 and 2014 (PWC, 2012). This market is led by Asian countries such as China and South Korea which form approximately 70% of the whole market (DFC, 2011). As the network infrastructures of the developing countries improve, the growth rate of the online game market may be maintained. Moreover, the free-to-play model, which features optional in-game purchases, will attract gamers who did not like the subscription model of online games.

Though blockbuster online games require a longer development period at higher cost, the lifespan of each game is generally longer than that of other games. They usually remain profitable for more than five years ("Global Game Industry Trend," 2012). One well-known example is *World of Warcraft,* which was released in 2005 and became the world's biggest online game with over 12 million players in 2010, but has recently been surpassed by *League*

of Legends. Another example is *Ultima Online,* which has been continuously played since 1997. Early casual online games have been praised for expanding the online gamer base by drawing female players ("Global Game Industry Trend," 2012). As casual games have proliferated online, female gamers have become a majority in the mobile game sphere (Snider, 2012).

5) Mobile Games

The mobile game industry is growing for many reasons such as the spread of smartphones and tablets, easy distribution of games via application stores, and the construction of the 4G LTE infrastructure. The mobile game market is expected to increase by approximately 12.3% on average from 2011 to 2014 (PWC, 2012). Considering that the whole game industry is increasing by approximately 3% during the same period, the growth rate of the mobile game is very high (DFC, 2011; Enterbrain, 2012; JOGA, 2012; Playmeter, 2012; PWC, 2012). According to the 2013 Global Games Market Report published by Newzoo, the market of smart devices, including smartphones and tablets, will grow by 18% in 2013 compared with the previous year (Newzoo, 2013a). Other market analyses agree with this prediction of huge growth (Enterbrain, 2012; PWC, 2012).

In the mobile game market, Asian countries including China, Japan, and South Korea make up more than 50% of the global market share (PWC, 2012). In 2014, the market share

of Asian countries is expected to rise to 60% due to the expansion of the Chinese mobile game market (PWC, 2012). Approximately 32% of smartphone minutes are used to play mobile games (Khalaf, 2013). Currently, 90% of mobile games are provided in the form of mobile applications since the unique functions of smartphones such as GPS are not easily applied to mobile web games.

Traditionally, the casual genres of mobile games such as puzzles or racing were popular since they were easy to play while on the move or on short breaks. Games requiring more immersion or longer playtime were regarded as not appropriate for mobile devices due to their relatively small screens and the low battery capacity. However, mid-core games—which are more competitive and challenging than typical casual games, but still simple enough to engage a mass audience--have begun to proliferate in the mobile game market recently (Digieco, 2013).

Mobile games are notable for attracting a more diverse user base, one that even includes toddlers (Newzoo, 2013b). For game developers, the mobile application stores lowered the entry barriers and game development itself became much easier due to free development engines such as Unity. Though the quantitative expansion of mobile games succeeded in attracting the light gamers, qualitative improvement has to follow in order to satisfy traditional heavy gamers.

V. Recent Trends

1) Cloud Gaming

The logic of cloud gaming is similar to video on demand (VOD) service. As audiences watch movies or TV programs stored in the external servers via VOD streaming services, gamers can play video games installed in external servers via cloud gaming services. Since numerous high quality video games are stored in an outside server, gamers can play video games via their televisions, smartphones, or any other devices, provided they are connected to the Internet. Prominent cloud gaming services include OnLive, Gaikai, and CiiNow.

Cloud gaming is expected to alleviate technology disparities between gamers (Ryu, 2013). In the 1980s, players had to own expensive home consoles. In the 1990s, gamers had to possess computers with high processing power and costly memory cards to play the most advanced PC games. Cloud gaming services allow players to access cutting edge games on a variety of devices and for this reason, cloud gaming might reduce the gap caused by the gamers' economic status. However, while the capabilities of the user's device is less important, cloud gaming still requires high speed broadband.

Cloud gaming will establish the multi-screen gaming environment (IDATE, 2012).

Gamers can play video games seamlessly via multiple devices since the game software and the gaming information are saved in the external servers. Gamers who connect to the same online game with different devices might be able to play together in this environment, and this new flexibility may introduce a shift in the video game sphere, exerting strong influences on the game developers and device manufacturers as well as the individual gamers (Ryu, 2013). In these ways, cloud gaming marks another watershed moment in the video game sphere, influencing game development, device production, and the player's experience.

The spread of cloud gaming will become a threat to existing gaming device manufacturers since gamers will not buy expensive game consoles or other new devices if they can play the same games without those devices (IDATE, 2012). Thus, console manufacturers have had to address cloud gaming in the manufacture of their game consoles. For instance, Sony, which produces the PlayStation platform, purchased Gaikai in 2012 for $380 million, and will introduce the streaming service with the Playstation in 2014 (Hruska, 2013). Console makers may also need to address the provision of multi-screen services; while cloud gaming allows play via a variety of devices, the console manufacturers can only provide services through a limited selection of hardware, such as consoles and handheld devices. At the same time, cloud gaming will give opportunities to video game developers. Traditionally, developers had to customize a video game for each operating system and diverse platforms; with cloud gaming they will be able to create various versions with the

minimum amount of development, allowing great cost savings.

Cloud gaming still faces certain challenges. For now, there may be a time delay between the gamer's movements and the reactions in the game environment. This happens because of the distance from the gaming device to the cloud server. To solve this problem, the network and the server quality should be improved (IDATE, 2012). Establishing the optimal control environment for each device is also an issue (IDATE, 2012). While one of the strengths of cloud gaming is that gamers with different devices can play the same multi-user online games simultaneously, big differences in devices may make this impossible and this may discourage adoption; for example, if gamers playing with tablets can never compete with the gamers with consoles, the tablet gamers may feel less value in using the cloud gaming services.

2) Serious Games

Though serious games may be defined in different ways, many scholars agree that these games are designed to simulate the accomplishment of particular purposes that are difficult to conduct in real situations (Kevin, 2006; Squire & Jenkins, 2003; Van Eck, 2006). While serious games are often identified with education and the transfer of knowledge, they are used in a variety of contexts, including medical applications for physical rehabilitation or psychological treatment. Ben Sawyer and Peter Smith (2008) created a comprehensive

typology of serious games, identifying several sectors of use: 1) Government and NGO; 2)

Defense; 3) Healthcare; 4) Marketing and Communications; 5) Education; 6) Corporate; and

7) Industry. Within these sectors, serious games are used for health, advertising, training,

education, science and research, production, and work.

The serious game market is dramatically expanding and is predicted to grow to 10

billion euros in 2015 (IDATE, 2010). In August 2013, market research firm Ambient Insight

predicted that the global game-based learning market, not including hardware, will increase

by a compound annual growth rate (CAGR) of 8.3%, from $1,548,800 in 2012 to $2,309,600

in 2017. The global simulation-based learning market was expected to grow at a higher rate,

with a CAGR of 23%, increasing from $2,364,0400 in 2012 to $6,648,890 in 2017 (Adkins,

2013).

Games for medical and health care include medical treatment simulation games,

rehabilitation games, and exergames. With the development of consoles' enhanced motion

detection technology, many gamers have adopted exergames (Parker-Pope, 2005; Warren,

2006). Nintendo is leading this industry with many popular exergames such as *Wii Sports* and

Wii Fit (Warren, 2006). Microsoft and Sony also joined in this profitable business with

competitive content such as *Nike+ Kinect Training*.

Military use of games has developed over the past three decades, as games offer

economic and other practical training advantages, training personnel to function in situations

that would be dangerous or expensive to recreate. Military applications include simulation games for national defense that predict the result of military actions and military training games which educate soldiers in diverse areas such as flight deck operations, combat, or piloting a helicopter (Hsu, 2010). In 2011, an MMORPG named MMOWGLI was released for the use of the U.S. Navy. The U.S. Armed Forces also established a game platform named the Defense Acquisition University (http://www.dau.mil/default.aspx) to provide various military training games.

The development of serious games in the public sector is led by governmental organizations and NGOs. These games are generally designed to convey messages to the public by featuring various social, political, and environmental issues. Asi Burak's government simulation game, Peacemaker (http://www.peacemakergame.com/), allows the user to play the Israeli prime minister or Palestinian president, and is designed to encourage better understanding of the conflict. Another example, *Darfur Is Dying* (www.darfurisdying.com), was made by the University of Southern California to spread awareness about the humanitarian crisis in this region in Sudan. *Free Rice* (http://freerice.com/about), quizzes players and donates 10 grains of rice to the United Nations World Food Program for each player's correct answer.

Formal and informal education is one of the most active fields of serious game development. Many academic studies support the educational efficiency of video games,

(Bainbridge, 2007; Barab, Thomas, Dodge, Carteaux, & Tuzun, 2005; Green & Bavelier, 2012), and there is a substantial body of literature on games and learning. Malone and Lepper (1987) describe four motivating factors in learning, which can be applied to games: challenge, curiosity, control, and fantasy. Applying these factors, an effective game will include characteristics of surprise, clear and attainable goals, choices that lead to meaningful consequences, and connection between the game's narrative and the skills the learner acquires, as occurs in simulations. These elements create an intrinsic motivation in the student. Worm and Buch (2014) add competition as another important element in e-learning, noting that it results in heightened learning efficiency.

There is a variety of approaches to games and learning; some of the most prominent are behaviorism, constructivism, and cognitivism. Behaviorism, with its focus on operant conditioning through positive and negative reinforcement, is sometimes suitable for designing games with drills and rote memorization but is widely criticized as ineffective for more complex, high-order learning (Paraskeva, Mysirlaki, & Papagianni, 2010; Charskey, 2010; Prensky, 2001.) Learning games based on a behaviorist paradigm rely on extrinsic motivation, and have been described as edutainment (Papert, 1998) or cases of gamification (Ferrera, 2012), where game-like elements are applied to a learning situation, but in a superficial way. Serious games have the characteristic elements of video games such as multimodality, interactivity, specific frame of situation, narrative, and social use, whereas

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gamification modifies traditional learning modes, only adopting limited elements of games. Gamification has been criticized for an overdependence on reward systems, with an inattention to other elements such as aesthetics, usability, and balance. (Ferrera, 2012).

Cognitivists approach knowledge as actively constructed in the learner's internal mental process, based upon existing knowledge structures acquired during the learner's prior experiences. Mayer's (2005) cognitive theory of multimedia learning adapts these principles, focusing on learning as coded in auditory and visual channels of finite capacity and learning as an active process involving the individual student's filtering, interpreting, and integrating of information. Multimedia learning applications including games must provide coherent verbal and graphic information, so that the user can select relevant components and integrate them into knowledge structures. Furthermore, designers must be aware of the user's limited cognitive load, presenting information in small chunks and moving from simple to more complex concepts (Grietzer, Kuchar, & Huston, 2007).

Constructivism also focuses on the internal, active nature of learning. This viewpoint describes learning as a process of constructing knowledge, rather than acquiring it through knowledge transfer. Students' past experiences will affect their learning, so that learning is a very local, subjective process in which the student creates his or her own mental representations through interactions with his or her environment. Seymour Papert (1981) introduced the concept of microworlds to describe a limited reality where the student can

learn though exploration and play. He suggests that microworlds, a concept that can readily

be applied to education and games, should be simple, general, useful, and syntonic, or

connecting with the learner's past experience and existing knowledge (1980). Learning is

facilitated in the constructivist paradigm through asking students to solve problems, react to

situations, create solutions, and think reflectively about their experiences (Charskey, 2010).

Educational simulations, such as flight training practiceware or virtual labs, allow the student

to acquire knowledge through activities that directly mimic real-world experiences. While

serious games can also facilitate learning by doing, they often have less fidelity to reality and

more abstract representations than simulated environments (Aldrich, 2009).

3) Social Games

A social network game connects to the gamer's social network sites or messenger

services. In this kind of online game, gamers' interactions with their social networks are

designed to influence their game play, encouraging them to promote the games, and act as a

voluntary viral marketing tool (Oracle, 2012). While the traditional game industry focused on

young male gamers, social network games encourage a variety of non-gamers to participate

in the game sphere with their simple design, casual formats, and additional socializing

functions. Beyond sales in app stores, social games also generate revenue through

microtransactions and in-game advertising (ESA, 2013).

In the initial stages, Facebook and its numerous users led the surge in social games. Zynga, which published many social games such as *FarmVille* on Facebook and held favored status as a game developer for the mega-site, was a key factor in this phenomenon. However, the synergy between Facebook and Zynga began to weaken while social gamers gradually moved from the PC-based Facebook gaming platform to mobile platforms. Major game publisher Electronic Arts announced in 2013 that it will produce fewer social games for Facebook. Zynga, which had became one of the biggest online game publishers, is now in crisis since it could not quickly catch the trend of social games moving to mobile platforms (del Castillo, 2013; Corriea, 2013).

The messenger-based mobile social game model originated in South Korea (Jung-a, 2013). The two most popular mobile social games, *Anipang for Kakao* and *Dragon Flight for KaKao*, had more than 20 million downloads in South Korea (KOCCA, 2013b). The enormity of this number becomes even more salient when one considers that the total population of South Korea is approximately 50 million. In addition, more than 30 million Koreans have downloaded at least one Kakao game (KOCCA, 2013b). Literally, a majority of Koreans are attracted to Kakao Talk's mobile social games.

Many global social game publishers have taken part in this phenomenon. A Japanese social game publisher, GREE, released a mobile messenger application which will be used as a game platform, and major Chinese Internet company Tencent, which runs mobile

messenger service WeChat, announced plans to release a game platform. In addition, Facebook announced in the summer of 2013 that it has decided to start its own mobile game platform service. Facebook-centered social network games are moving to the mobile messenger platforms. With so many major players joining the profitable social game market, competition will be intensified (Negishi, 2013).

This competition among the platform providers will offer opportunities for game publishers. Unlike the console and the online game industries, led by a handful of major game publishers, social network games can be created by smaller independent companies because the development cost for the mobile games is much less expensive. Moreover, once they become popularized, these games proliferate dramatically, helping startup publishers become major players. For example, King.com became a sensation in the video game industry with its 2012 social game *Candy Crush Saga*; by late 2013, the company reported the game had been installed half a billion times on Facebook and mobile devices (Geron, 2013).

4) Realities in Video Games

Constantly advancing technologies such as virtual and augmented reality are expected to be major drivers in the further development of gaming. Oculus VR's Oculus Rift is at the forefront of consumer-level virtual reality gaming, while Google's wearable device,

Google Glass, is expected to lead the augmented reality gaming environments (Smith, 2013; Takahashi, 2013).

Oculus Rift is a goggle-shaped head-mounted display that provides the gamer with the subjective visual perspective of his or her avatar. Many influential game publishers such as Valve, id Software, and Mojang are reported to be developing games for this unreleased but critically acclaimed VR device. It will be released in 2014 and offer gaming environments for the console, PC, and Android operating systems. Beyond Oculus Rift, venture companies such as 360specs and vrAse plan to develop virtual reality applications for smartphones, raising funds via crowdfunding site Kickstarter to make these applications. These applications are designed to operate via smartphones installed with supplementary goggles and will enable gamers to experience virtual reality gaming without purchasing the expensive devices. However, the performance of these applications and the games being developed for them are unconfirmed as of late 2013.

Google's Android-based wearable device, Google Glass, is expected to contribute to the popularity of the augmented reality games (Parkin, 2013). Mobile application developer BrickSimple revealed the exclusive game application for Google Glass, *GlassBattle,* an adaptation of the classic board game Battleship. While wearing Google Glass, gamers can activate the game on the upper-right side of the display. Since the gamers can play via their voice control, they can play games while engaging in daily activities. Games such as

GlassBattle are an early form of augmented reality games. Later, when wearable devices such as Google Glass become popular among gamers, more advanced AR games are likely to appear.

Video game scholars have always been interested in similarities and differences between reality and the game environments, looking at how gaming environments immerse gamers in virtual space and affect the gamers' perception level of reality (Anderson, 2004; Lin, 2013a; Williams, 2006) . Many studies argue that video gaming can cause excessive immersion and encourage violence among players; this perspective is similar to traditional media cultivation theory (Anderson & Bushman, 2001; Gentile, Lynch, Linder, & Walsh, 2004; Silvern & Williamson, 1987; Uhlmann & Swanson, 2004). Other studies find that there is little relation between the gamer's behaviors and video games (Sherry, 2001; Williams, 2006). However, there is a growing need to review these arguments, as advanced technologies increasingly blur boundaries between virtuality and reality.

5) Collaboration between Video Games and Toys

The console manufacturers, hit by the spread of mobile games, have tried to create new business models by cooperating with allies outside the video game industry. The alliance between video game producers and toymakers is leading this trend (Evangelista, 2013). Activision Blizzard's *Skylanders* series had great success with this kind of collaboration,

combining action figures with video games to provide additional value to gamers. This kind

of collaboration has become a trend in the video game industry. Disney released *Disney*

Infinity, which ties its character toys with their video games, and Nintendo released a game

named *Pokemon Rumble U*, which enables interactions with the Pokemon figurines. One of

the biggest toy manufacturers, Hasbro, has joined this trend as well.

Video game companies continue to try to collaborate with different industries in

order to provide additional value to consumers and increased revenue. Often, this

collaboration connects video games to other cultural products such as movies or music

(Gibbons, 2011; Marshall, 2013). Producing figurines of popular game characters is also

common. However, recent collaborations are different from traditional business

diversification strategies since these toys and video games are not standalone but interact

with each other by using the digital technology. If a gamer puts a specific character figure on

the board linked to the console, the gamer can control the same character in his or her game

playing. This encourages gamers to collect more valuable physical toys, to use them in the

virtual gaming space. NFC (Near Field Communication) technology has allowed the

development of these gaming environments (Crawley, 2012; Dyer, 2013). Though these

kinds of collaboration require more investment than traditional video games due to the

inventory management expense, more toy makers and video game producers are expected to

enter this business market (Evangelista, 2013).

6) Revaluation of Video Games

There has been ongoing debate over the value of video games as a work of art. Some scholars emphasize the differences between video games and true art forms, focusing on the elevated social status of art and on its improving effects on society. Video games are also sometimes framed as children's media with no importance or integrity (Newman, 2013). Roger Ebert (2010) provides two distinct differences between video games and traditional arts: 1) video games do not explore the meaning of human existence, but pursue pure excitement, and 2) video games are influenced by the gamer's play, while the role of the producers is absolute in arts.

However, other scholars argue that the domain of art is expanding and can include video games (Deen, 2011; Smuts, 2005; Gee, 2006). In 2011, the U.S. Supreme Court made a judgment that acknowledged video games as an art form protected by the US Constitution's First Amendment, which guarantees the freedom of expression for film, books, and other creative works. Meanwhile, formal museum exhibitions have begun to display video games as art. In 2012, the Smithsonian American Art Museum included video games in an exhibition named *The Art of Video Games* and in March 2013, the New York Museum of Modern Art had 14 video games on their exhibition list. The artistic value of video games is still under debate, however, with ramifications in cultural and policy.

7) Console Wars: The Challenge of the Androids

The wide scale adoption of new technology may cause the decline of existing technology that fails to adapt to the new environment and the video game industry is no exception. The console game industry is facing a crisis due to the development of the mobile-based gaming market (Chou, 2013). The expanding area of mobile games, which is supported by the spread of smart devices, has encroached on the territory of traditional handheld game devices. In addition, the recently emerging Android OS consoles are challenging the established console manufacturers. Until now, only three big players--Nintendo, Sony, and Microsoft--have shared the huge console game market. However, many developers are releasing Android-based console devices, which may cause a turbulent period in the console industry (Langshaw & Reynolds, 2013).

Android consoles are devices that use the Android operating system as a gaming platform. They enable the gamers to play numerous mobile games on TV. The conversion from the mobile to the console version is very simple since the two formats share the same operating system, which means there will be an abundancy of games available. Though the gaming experience itself may not be superior to that of the existing consoles, the relatively inexpensive price of the devices and the games will make these new consoles competitive (Langshaw & Reynolds, 2013).

There are some reasons to expect the success of the casual game-centered Android consoles in the hardcore-centered console market. First, gaming with the optimized controllers of the Android consoles will transcend the limited gaming operations possible with touchscreen devices, which will appeal to the mobile gamers. Second, the rising popularity of the Android operating system will encourage game developers to produce more games for these consoles. Third, the open platform system will pull down the high barriers of entry to console games, which will provide opportunities for the indie developers. Lastly, the possibility of establishing a multi-screen gaming environment created by the same OS and shared between various devices will offer a new experience to gamers (KOCCA, 2013a; Pilsik, 2013).

Android consoles are divided into TV-based consoles and handheld devices. They include:

1) OUYA (console): Developed via a crowdfunding system, Ouya positions itself as an easily convertible and hackable device, which differentiates it from the existing console devices. By cooperating with a cloud gaming service provider, OnLive, Ouya tries to overcome the limits of mobile games.

2) GameStick (console): Also funded by a crowdfunding site, GameStick defines itself as the smallest console in the world. It is similar to USB sticks in size and shape, and can be connected to TV through HDMI output.

3) Shield (handheld): The distinctive characteristic of Nvidia's handheld gaming device, Shield, is that it enables gamers to play games installed in their PCs via Shield. In addition, if gamers connect the device to a TV, they can use the PC as a cloud server and play the PC games on TV.

4) Wikipad (Tablet): Wikipad is a gaming device with a 7-inch touchscreen. The controller of this device is detachable, so gamers can use it as a gaming device, while they can also use it as a normal Android-based tablet.

5) PlayMG (handheld): PlayMG targets young gamers who cannot afford the expensive smartphones or iPods. The primary distinction of this device is its low price.

Although the emergence of these Android gaming devices might create challenges for the existing console manufacturers, it will give opportunities for the video game developers. Nevertheless, there are some problems to be solved. For instance, if the Android console manufacturers fail to provide attractive content at the early stage, the gamers will not turn their attention from the existing hardcore-centered console games (Hill, 2013; Langshaw & Reynolds, 2013).

8) Crowdfunding

Crowdfunding, which has been applied to various fields, provides opportunities for

the independent game developers and game device makers who have had difficulty finding support for the development of their projects. Kickstarter, founded in 2009 in the U.S., is leading this trend. For the first four years, more than 40 thousand projects attracted investment via this website. The success rate of these funding requests was approximately 44% ("Kickstarter Stats," 2013). Android-based game console Ouya benefited from this model, as $8.5 million was donated to support a smart watch, Pebble. This funding mechanism has facilitated the development of many gaming devices and software (Brodkin, 2013). However, crowdfunding does not always bring positive effects. Contributors have begun to feel "Kickstarter fatigue" due to too many funding requests (Graham, 2013).

9) Always-online Policy

The increase of digital distribution and the emergence of cloud gaming encouraged major players in the game industry to embrace always-online policies. Previously, gamers could play video games by operating the physical discs or the game software installed in their devices whether they were online or offline. However, gaming devices and online games have begun to require gamers to play online. Microsoft announced an always-online policy that demanded 24-hour mandatory check-ins, attracting many complaints from gamers (Payne, 2013). Blizzard's Diablo 3, which allowed gamers to engage in offline play in previous versions, also included a mandatory login to play the game. These kinds of online

requirements will be intensified along with the trend of preferring digital distribution to physical package sales (Rose, 2013b). These policies will be beneficial for the service providers, allowing them to prohibit the gamers from excessive game sharing and to manage gaming information. However, gamers assert that these policies infringe on their privacy. The fact that the gamers cannot play the games they have paid for, in the case of poor Internet conditions, is also controversial (Orl, 2013).

10) Revenue Models: Free-to-play, Advertising, and Microtransactions

In the past, the major game publishers adhered to the package sales or the pay-to-play model, and regarded the free-to-play (F2P) model as a strategy for minor games targeting the niche markets. Recently, however, major publishers including Electronic Arts have embraced F2P as one of their primary business models. Free-to-play has already become a dominant business model for social games and mobile games (Tack, 2012). Many online game publishers are also converting their MMOGs from pay-to-play to free-to-play; one of the popular MMORPGs, *Lord of the Rings Online*, switched its charging method to this free model, and Activision Blizzard recently decided to release the online version of its famous console game *Call of Duty* on the F2P model in China.

Since the game itself is complimentary, gamers can try it without serious commitment. In addition, F2P is expected to alleviate the copyright infringement issue that is

regarded as one of the most serious problems for video game publishers. The strict DRM policies of the packaged sale games were helpful in protecting licenses, but they attracted gamers' complaints, and this pay-to-play model induced many gamers to play via illegal game servers (Graft, 2010).

The free-to-play model is increasingly dominant (Campbell, 2013; Tack, 2012). Starting from the mobile game areas, this model is widely applied to online games. Recently, the console game industry also began to provide F2P games. However, some critics—including gamers--argue that the F2P model causes unequal conditions between players (Menz, 2012). The main business model of F2P games is to sell various in-game items to gamers, in microtransactions. In order to increase the sales of certain game items, game developers may assign competitive attributes to these items. A player who can purchase these items will have advantages in the gaming environment, and this is sometimes critically referred to as the "pay-to-win" model. Because of these concerns, some games, including *League of Legends*, only sell items that do not assign additional abilities, but are only for adorning players' avatars. However, the concern over sales of items with competitive attributes still exists. Though video game publishers seem to agree with the efficiency of the F2P paradigm, the details of how to effectively design this model and create a reliable revenue stream remains inconclusive.

Advertising is another growing source of revenue for video games, and is expected to

increase with the spread of the free-to-play model and rising popularity of social games.

Globally, ad revenue has risen from over $1.06 billion in 2007 to over $2.18 billion in 2011,

with a projected increase to over $3.71 billion in 2016 (ESA, 2013).

Microtransactions have also become more widespread in recent years and are used in

online games including social games, free-to-play games, and even in pay-to-play games

(Noonan, 2013). Major companies including Electronic Arts, Sony, and Microsoft have

embraced this model, in which players may spend small amounts of money on optional game

features including items that give advantages to the player, enhanced cosmetic attributes for

players' avatars, and access to new game content. This practice has generated controversy

among gamers, who have criticized the model's use with games that already charge the

consumer a flat payment at purchase (about $60 in the United States) and who perceive that

the free versions of games are deliberately being designed poorly, to force players to pay

(Statt, 2013). In some cases, microtransaction amounts are considerable, such as in the case

of *The Simpsons: Tapped Out* or *Gran Turismo 6*, which charge players over $50 in some

single transactions. This revenue practice has also attracted the attention of regulators; in

2013, the Australian Competition and Consumer Commission began an investigation of in-

game purchases, focusing specifically on the spending of youth gamers (Battersby, 2013).

VI. Recent Research Agendas

Emerging research on game technology has focused on a variety of ways to make games more realistic with faster, more accurate motion tracking, more efficient, detailed procedural content generation, and affective computing.

1) Motion Tracking

Significant research has gone into improving the immersive experience, including innovative motion tracking technologies that may be applied to entertainment and serious games. Researchers at the Carnegie Mellon University Human Computer Interaction Institute and Disney Research Pittsburg have developed motion-tracking technology, Lumitrack, which costs less than currently available motion tracking devices, significantly reduces time lag, and responds with greater precision to user input. The peripheral hardware works by projecting a structured pattern called a binary-m sequence onto the tracked object, and the technique offers peaks speeds of over 1000 tracking frames per second delivered about 2.5 milliseconds behind real time.

Another potentially revolutionary motion-tracking technology known as WiTrack uses radio signals to track users' movements and is capable of detecting motion through walls. Developed at MIT's Computer Science and Artificial Intelligence Lab, the system uses multiple antennas that transmit and receive radio signals reflecting off the user's body, and

can pinpoint 3D movement within 10-20 centimeters. Unlike wireless signal motion-tracking technology, WiTrack does not require the user to carry a wireless device or remain in front of stationary sensors.

The Sixtense Motion Controller, was funded via Kickstarter in fall 2013 and is expected to be commercially available in fall 2014. The device uses motion-tracking modules, a wireless base station, and two motion controllers—one for each hand--to track the user's leg, arm, and head movements.   Combined with the Oculus Rift, to deliver an immersive experience.

2) Procedural content generation

Procedural content generation (PCG) refers to the automated creation of different kinds of game elements including rules, levels, maps, and artifacts. This mechanism, which uses algorithmic methods to generate content with limited human input, saves production costs and offers the potential of infinitely replayable games, as PCG creates an endless stream of novel content. PCG is used both offline and online. Offline, it helps game developers experiment with design, quickly making useable prototypes of the game to test gameplay experiences (Betts, 2014). Online PCG operates under intense time constraints, responding seamlessly in real time to player behavior. A common approach to PCG is search-based, with the game using algorithms to explore the game space for appropriate, appealing content

(Chen & Robert, 2013). Popular games that integrate PCG include Mojang's Minecraft, Blizzard Entertainment's Diablo3, and Valve Software's Left 4 Dead series.

Betts (2014) argues that as PCG technology develops, it will offer numerous advantages. PCG content exists in a compressed state until recognized by the game, at which point a process of data amplification expands the stored content. The advanced complexity and scale of modern games places heavy demands on system memory, especially in portable devices, and this compression helps to alleviate problems of memory shortage. PCG also helps fulfill gamers' expectations for increasingly detailed content, automating the production of environments and artifacts, reducing time and labor costs for the development team. Additionally, the production of novel content with PCG allows players to repeat games with different experiences each time.

This technology offers great promise, potentially making game production much more efficient, and content generators have proliferated in recent years (Horn, Dahlskog, Shaker, Smith, & Togelius, 2014). Discussing the future of PCG, Togelius et al (2013) note several challenges, including: Creating original-looking content; stylistic consistency between generated game levels; PCG that can create multiple types of content; the integration of music and other content; and integrating more efficient animation processes. Chen and Roberts (2013) specifically criticize the search based PCG, arguing that this form of content generation is more appropriate for offline use; when used on the fly, SBPCG can have

difficulty quickly locating content that is appropriate in the context of the gameplay. Instead, they propose a learning based PCG framework this relies on knowledge and experience gathered from developers and beta testers, gathering information via data-driven machine learning. The increasing number of generators makes systematic evaluative methods particularly pertinent. Focusing on the generation of game levels, Horn, Dahlskog, Shaker, Smith, and Togelius (2014) studied several types of level generators that use different algorithmic methods, to explore how to measure different generators effectiveness in various areas including the creation of the game environment and connectivity of the levels.

3) Affective Computing

Affective computing in videogames focuses on the emotional engagement of the player. As a form of interactive media, games can evoke emotional reactions and also react to gamers' responses, both from direct input through controls and through the players' physiological feedback such as heartbeat and facial expression. Commercial games measuring and integrating physiological feedback have existed since the 1990s; one well-known example is Konami's arcade game *Tokimeki Memorial Oshiete Your Heart*, and their complexity transcends simple biofeedback interfaces. Game creators can use this type of feedback in a variety of ways, designing the game to react to emotional states including the player's level of frustration, task engagement, and emotional involvement with the game

(Gilleade, Dix, & Allason, 2005). Information about a user's emotional response--such as through monitoring heartbeat, galvanic skin response, or pressure used on a gamepad—can allow the game to generate content according to the emotional state of the player, indicate a player's affective state to other players in an online game, and lead to innovative game mechanics (Sykes, J. & Brown, S., 2003).

4) Design and Player Behavior

Recent scholarly studies on video game design and player behavior include: 1) the effects of video games on gamers, 2) video game player practices, 3) video game structures and designs from the video game producer's point of view 4) debates on critical characteristics of video games and 5) sociocultural issues related to video games.

The topic of players and media effects has historically been one of the most popular agendas in game studies. Many scholars share interests in how violent games might affect gamers' aggression (Anderson & Bushman, 2001; Hartmann & Vorderer, 2010; Ivory & Kaestle, 2013; Sørensen, 2012). While some studies have revealed a positive relationship between violent games and aggression (Anderson & Bushman, 2001; Ivory & Kaestle, 2013; Lin, 2013b), other studies assert that there is little or no causal relationship between game content and aggressive behavior outside of the game (Jerabeck & Ferguson, 2013; Sherry, 2001). Recently, scholars have explored the effects of immersive technology such as motion-

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capture playing on gamer aggression (Charles, Baker, Hartman, Easton, & Kreuzberger, 2013).

Industry and academic researchers also investigate the diverse elements that heighten gamers' enjoyment. According to recent studies, factors related to the level of enjoyment include competitive situations, need satisfaction through video gaming, and the feeling of presence (Reinecke et al., 2012; Shafer, 2012; Skalski, Tamborini, Shelton, Buncher, & Lindmark, 2011; Tamborini et al., 2011; Tamborini, Bowman, Eden, Grizzard, & Organ, 2010). For instance, some studies empirically revealed that satisfying intrinsic needs such as autonomy, competence, and relatedness increased game enjoyment (Reinecke et al., 2012; Tamborini et al., 2010). Skalski et al. (2011) argue that the feeling of presence caused by the interactivity of games was related to enjoyment. Scholars have also applied the flow model to video gaming experience. "Flow" means the status of the gamer's immersion, and studies show that the balance between the gamer's skills and challenges in games contribute to stronger perceptions of flow (Jin, 2011, 2012).

Behrenshausen (2012) argues that more scholars have to focus on the player-centered research which is an extension of traditional "active audience studies." Many studies exploring players' activity focus on the relations between game-related behaviors and the demographic characteristics of gamers such as gender, race, and generation (Cunningham, 2011; Jansz, Avis, & Vosmeer, 2010; Shaw, 2012; Yang & Huesmann, 2013). For example,

Jansz et al. (2010) investigated gender differences in motivation for playing a simulation

game, *The Sims 2,* and found that male gamers placed emphasis on the social interaction

more than female gamers, a conclusion which defied general expectations.

Meanwhile, studies on gamers' cultural practices are divided into gamers' practices

in real world situations and gamers' activities in virtual worlds (El-Nasr & Smith, 2006;

Gibbs, Mori, Armond, & Kohn, 2012; Paul, 2011; Sotamaa, 2010). For example, one study of

real world practices investigated "modding" culture. The study showed that gamers'

modification of gaming software or hardware can help them learn various skills, such as

computer science, mathematics, and physics. (El-Nasr & Smith, 2006; Sotamaa, 2010).

Meanwhile, studies on in-game practices explore gamers' social activities in virtual worlds

such as building memorials within the game world in order to express grief and memorialize

the dead (Gibbs et al., 2012).

Other research looks at the structuring and design of video games from the

perspective of producers. These include exploration of the relationship between video game

structure and gameplay (King, Delfabbro, & Griffiths, 2010). Many scholars, for instance,

explore the balance between in-game achievements and rewards (Begy & Consalvo, 2011;

Jakobsson, 2011; Moore, 2011). Begy et al. (2011) insisted that appropriate rewards, received

after in-game achievements to reinforce the gamers' in-game positions, motivate them to

continue playing. Scholars also examine the different effects caused by different game

control mechanics (De Paoli, 2013; Karhulahti, 2013).

Studies on critical characteristics of video games are regarded as an extension of the dispute between narratologists and ludologists. These studies focus on elements of video games such as gaming mechanics, semiotic elements, or interactivity. While Deen (2011) regards interactivity and embodiment as critical elements of video games, Iverson (2012) argues that video games consist of both a mechanistic and a semiotic dimension, which gives credit to both perspectives of narratology and ludology. In addition, some contemporary scholars also explore whether video games should be regarded as art (Burden & Gouglas, 2012).

Other more multidisciplinary agendas include investigation of the influences of serious games (Bergeron, 2006; Charsky, 2010; Raybourn, 2007). These studies explore the effects of exergaming on gamer's health or the educational efficiency of edugames (Amory, Naicker, Vincent, & Adams, 1999; Charsky, 2010; Peng, Lin, & Crouse, 2011). For example, Peng et al. (2011) suggested that active video games (AVGs) could facilitate moderate intensity physical activity promotion. Charsky (2010) and Amory et al. (1999) argue that educational games can influence the learner's motivation, if the games are designed well.

Some scholars investigate legal or political issues about video games. For instance, Chew (2011) explores virtual property right issues between gamers and game publishers. Song, Korba, Yee, and Chen (2007) claim that protecting virtual property would be a

potential solution for reducing virtual crimes, such as hacking and stealing other gamer's

gaming items. In addition, parental mediation of children's media use continues to be a

leading issue. For example, Shin et al. (2011) revealed that parents' checking of game ratings

was related to children's gaming frequency and engagement in deceptive gaming behaviors.

Scholars also have analyzed the video game industry with academic perspectives (Williams,

2002).

Meanwhile, industrial agendas focus on recent business trends, such as the launches

of new game consoles—a leading topic in major trade publications like *Gamasutra*. The

announcement and subsequent withdrawal of Microsoft's new policies was a major concern

in 2013; although Microsoft initially claimed that their new console would require online

check-in every 24 hours, it removed the requirement due to the complaints from consumers

and concerns about competitors' more gamer-friendly policies. Independent developers were

another primary interest in 2013. While their opportunities seem to increase due to the self-

publishing policies of major console makers Nintendo, Sony, and Microsoft, there also are

threats such as the increasing market share of a small number of major publishers, the spread

of the free-to-play model, and concerns about declines in game quality (Graft, 2013; Rose,

2013a).

The game industry has also shown a keen interest in studies on the potential effects

of violence in games. This issue was raised again after the devastating Newtown shooting in

the US, which killed 27 people. In the aftermath, some politicians and media outlets linked violent video game content with mass shootings. The effects of violent video games on players are still in dispute, and this will remain a primary topic on scholarly and industrial agendas (Rose, 2013a). Gamer activities, such as livestreaming or sharing gameplay, and the technological developments which enable these activities also gained interest from the game industry in 2013 (Graft, 2013).

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