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The Contribution of Game Genre and other Use Patterns to Problem Video Game Play among Adult Video Gamers

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Abstract

Aims—To assess the contribution of patterns of video game play, including game genre, involvement, and time spent gaming, to problem use symptomatology.

Design—Nationally representative survey.

Setting—Online.

Participants—Large sample (n=3,380) of adult video gamers in the US.

Measurements—Problem video game play (PVGP) scale, video game genre typology, use patterns (gaming days in the past month and hours on days used), enjoyment, consumer involvement, and background variables.

Findings—Study confirms game genre's contribution to problem use as well as demographic variation in play patterns that underlie problem video game play vulnerability.

Conclusions—Identification of a small group of game types positively correlated with problem use suggests new directions for research into the specific design elements and reward mechanics of “addictive” video games. Unique vulnerabilities to problem use among certain groups demonstrate the need for ongoing investigation of health disparities related to contextual dimensions of video game play.

Keywords

Video games; Problem video game play; Game play patterns; Genre; Game Mechanics

Introduction

For those enjoying even the occasional computer or video game, it is clear that the video game marketplace has diversified in the past decades and currently offers more types and styles of video entertainment than ever before. Despite this, research into the differences between video games has conventionally relied upon the video game ratings and content descriptors provided by the Entertainment Software Rating Board and has generally focused

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upon violent content (see: Anderson, Gentile, & Buckley, 2007 for a comprehensive review). While game typologies based on content have been explored in empirical research (Haninger & Thompson, 2004; Thompson, Tepichin, & Haninger, 2006) and as a practical framework for gamers and their parents (Dini, 2008), the current academic concern with video game “addiction” has not yet grounded itself in the game-level differences that define contemporary computer and video game genres. Fans of popular military-themed titles like *Call of Duty: Modern Warfare* and *Black Ops* are enjoying titles in the “first-person shooter” (FPS) genre (Jansz & Tanis, 2007), while the roughly 10 million subscribers to the fantasy-themed internet-based game *World of Warcraft* are participants in a “massively multiplayer online role-playing game” (MMORPG; Corneliussen & Rettberg, 2008)—to name just a few. For those seeking to understand how video game mechanics ranging from reward schedules to player perspective and online interactivity may shape the widely differing (and sometimes deleterious) experiences of video gamers today, genre preference and other dimensions of gamers’ play patterns represent important, but infrequently explored, variables.

Video Gaming “Addiction”

The argument that video and computer games (henceforth, “video games”) are addictive has provoked ongoing contention both in popular and academic circles (Petry, 2011; Wood, 2008; Young, 2009). Rapid technological innovation and market diversification has seemingly only escalated these concerns. Popular media attention, perhaps not surprisingly, has gravitated toward the most sensational stories involving video game-related accident and violence. Infant deaths resulting from game-addicted parents (Tran, 2010), violent Chinese boot camps for game-obsessed youth (Stewart, 2010), real-life murders precipitated by “in-game” theft (Haines, 2008), and even a matricide provoked by an adolescent’s blocked access to his Xbox game console (Kropko, 2009) have been publicized and featured in investigative television exposés. While sensational cases like these that suggest underlying psychopathology have been readily dismissed by the video game industry’s advocacy and public relations arm (Association for UK Interactive Entertainment, 2010), systematic evidence for a distinct and widespread problem use syndrome has been steadily growing. A comprehensive recent review article on video game addiction (Kuss & Griffiths, 2012a) describes fifty-eight papers that address the topic of problem video game play. Ten of those offer varying prevalence figures for video game addiction, either in general populations or populations of video gamers. Among adolescent video gamers, 8-12% have been found to suffer from video game addiction or a video game related impulse control disorder. Among general populations of adolescents internationally, rates from .05-12% have been reported (Kuss & Griffiths, 2012a, 2012b). Given the varying frameworks for conceptualizing and measuring what we refer to here as problem videogame play (PVG) and the various sampling techniques and national/regional populations that have been examined, more precise prevalence estimates are not available. What is clear, however, is that those suffering from PVG—however it is measured or categorized—are experiencing significant (and, in some cases, severe) consequences of PVG, ranging from diminished academic performance (Smyth, 2007) to poor sleep (Dworak, Schierl, Bruns, & Struder, 2007), to aggression (Sublette & Mullan, 2010), to personal problems managing relationships (Liu & Peng, 2009). Perhaps most defining of PVG is the experience of a loss of control resulting in the perceived inability to curtail use even when negative consequences are being experienced—a characteristic shared with other emerging pathologies involving use of technological and social media (see Sim, Gentile, Bricolo, Serpelloni, & Gulamoydeen, 2012 for a review)

Structural Dimensions of Video Games and PVGP

One of the focal areas in recent theorizations of addictive gaming has been the design elements and structural dimensions that distinguish different game types, or genres, and may differentially precondition problem responses. One of the structural cornerstones of video game design is the implementation of rewards, a point which has long been recognized by behavioral psychologists examining video games (Loftus & Loftus, 1983). Some of the more explicit and formulaic forms of video game rewards have involved high scores, extra lives, free games, and level-ups for one's in-game character (Loftus & Loftus). More recently, video game rewards have often involved the acquisition of "experience points" or "XP" (King, Delfabbro, & Griffiths, 2010b), "achievements" (Jakobsson, 2011), as well as various appearance modifications and fashion items for one's in-game character, or "avatar" (Moore, 2011).

In light of the evident reward systems that have always been programmed into video games, popular analogies linking video games to addictive drugs emerged early (Poole, 2000). Neuroscientific research, however, has only recently taken up the examination of chemical pathways in video game reward, whereby the connections between substance dependence and video game "addiction" might be more fully elucidated. Findings in this area point generally to dopaminergic neurotransmission and potential dysregulation (Koeppe et al., 1998; Weinstein, 2010), the same primary process implicated in many forms of substance abuse (e.g., Volkow, Fowler, Wang, Swanson, & Telang, 2007). One study involving a motorcycle racing game demonstrated that players experienced a significant (10.5%) reduction in dopamine D2 receptor binding potential in the caudate after play (Weinstein, 2010), suggesting a video game related dopamine release comparable to that produced by amphetamine or methylphenidate (e.g., Volkow et al., 1994). Another recent study found more prevalent polymorphisms of the dopamine D2 receptor in adolescents with excessive online gameplay, indicating a potential genetic predisposition toward PVGP among those with fewer dopamine receptor binding sites (Han et al., 2007).

Similarly, the range of mechanics that has historically been found to condition gamblers, such as variable interval reward structures, overlaps with video game design mechanics (King, Delfabbro, & Griffiths, 2010a), and coin-operated video games have long been compared to slot machines in their operant conditioning paradigms (Griffiths, 1991). Additionally, gambling mechanics have been shown to increase problem video gaming habits (Hsu, 2009), despite the fact that very few people actually earn or win money through playing video games.

Issues with Specific Genres

Given the range of activities that today's video gamer can undertake in games and the equally large range of reward types and mechanics being used by game designers, it is reasonable to examine the typology of game genre used widely by the game industry and gamers themselves a meaningful framework for assessing PVGP risk. For almost two decades, studies have looked at different types of video and computer games (and their respective audiences), resulting in a wide range of genre categorizations—from Griffiths' codification of nine computer game genres (Griffiths, 1993) to Wolf's more than 40 (2002). While several studies have looked at a small number of genres and their players, providing valuable insights into the demographic and gameplay differences that separate players with different game style preferences (Ghuman & Griffiths, 2012), findings about specific genres suggest a potential concentration of PVGP in both the first-person shooter (FPS) and the massively multiplayer online role-playing game (MMORPG).

Popularized by the enormous success of Blizzard Entertainment's *World of Warcraft*, the MMORPG genre has polarized public and academic discourse. On one side of the debate, even some game designers have accused the genre of employing “exploitative” operant conditioning design (Hill, 2007) in highly self-conscious ways—an accusation at least partly substantiated by design manuals addressing reward schemes in MMORPGs (e.g., Bartle, 2003). On the other, qualitative social scientists have produced rich ethnographic accounts of the complex new sociocultural and economic phenomena transpiring in these “virtual worlds” (Boellstorff, 2008; Castronova, 2005; Nardi, 2010; Taylor, 2006). Perhaps not surprisingly, many of the studies to have examined PVGP in the past decade have done so using samples of MMORPG players. An fMRI based study examining cue-reactivity among players of the popular MMORPG, *World of Warcraft*, found that game cravings in MMORPG “addicts” highly resembled those found in drug dependence (Ko et al., 2009). Another administered a Stroop task and found that subjects classified as MMORPG addicts exhibited attentional biases similar to those previously found in alcohol, drug, smoking, and gambling addicts (Welte, 2002). A study of gameplay patterns found that MMORPG players were spending, on average, 25 hours per week playing, with more than 9% reporting 40+ hours per week of game play with a single MMORPG title alone (Griffiths, Davies, & Chappell, 2004). In an experiment assigning one of four different game types to a sample of 100 college students, study researchers found that those assigned to the MMORPG group reported significantly more hours played, worse overall health and sleep quality, greater interest in continued play, and greater interference with socializing and schoolwork (Smyth, 2007).

Alongside the MMORPG, the FPS represents another genre that has risen in the past decade to a position of public health and academic interest and concern. The FPS is an exclusively three-dimensional game interface in which the player assumes the implied body of the protagonist—generally leaving only the arms, hands, and firearms visible on the bottom of the screen. The genre came to popularity in the early 1990s, before the widespread adoption of the internet by the games industry, and was typically played offline. In recent years, however, a large proportion of FPS gameplay appears to be centered around online “death matches” (Bryce & Rutter, 2002) that pit one group of players against another, sometimes in organized tournaments offering cash prizes (Hutchins, 2008). Evidence for disproportionate rates of PVGP among FPS players remains anecdotal, although a number of empirical inquiries have established the unique appeal of these games, which currently represent the second best-selling video game genre for home consoles (e.g., Xbox, Wii) in the U.S., behind the far broader “Action” genre (Entertainment Software Association, 2011). Studies have focused upon a trio of structural dimensions that can potentially act to create strong gamer bonds (and/or increased PVGP hazard) among FPS players. The first is the genre's overwhelming emphasis on player-versus-player (PVP) competition and the mechanisms game designers have begun using to ensure that players with more time spent “unlock” more powerful weapons and skills and secure advantages over newer players (Jansz & Tanis, 2007). Second, the FPS genre provides opportunities for the formation of intimate collaborative relationships grounded in the fraternal relationships characterizing real-world military service and combat (Frostling-Henningsson, 2009). Finally, the genre excels at using a first-person perspective to create immersive, or “flow” experiences (McMahan, 2003) which appear to predispose gamers who have had those experiences to PVGP (Chou & Ting, 2003).

The enormous popularity of the MMORPG and the online FPS has led to a clear focus in recent video game research on the internet addiction. A wide number of recent studies of addictive video gaming have focused exclusively on online game addiction (see: Kuss & Griffiths, 2012a; Kuss & Griffiths, 2012b), or have looked at internet addiction scores in relation to game preferences (Lee et al., 2007) resulting in a clearer understanding of how

the internet may mediate PVGP for a growing number of gamers. At the same time, this tendency toward a focus on internet games has limited the broader inquiry into the structural and genre-based dimensions of games that may predict PVGP. As a recent study (King, Delfabbro, & Griffiths, 2010c) has demonstrated, game-level factors with the greatest impacts on problem use behavior—e.g., “leveling up,” “earning XP,” or “complex story” (see also: King, Delfabbro, & Griffiths, 2010b; Wood, Griffiths, Chappell, & Davies, 2004)—are contained in a number of both online and offline game genres. Thus research looking to a more comprehensive ecological assessment of structural risk might meaningfully address potential variance in PVGP risk between, for example, MMORPGs and role-playing games (RPGs) that are not played online (Elliott, Golub, Ream, & Dunlap, 2012).

Personal-level factors in PVGP

Although game-level dimensions of video-game play are clearly critical in the study of PVGP, many questions still remain about the extent to which game preference may reflect, or mediate, underlying personal characteristics affecting personal vulnerabilities to PVGP (Wood, 2008). Males, for example, have been shown to exhibit more frequent problem use patterns (Grüsser, Thalemann, & Griffiths, 2006) while also being more frequent users of video games (Fisher, 1994; Griffiths & Hunt, 1998). A recent fMRI-based study demonstrated significant differences between mesocorticolimbic (reward center) activation in men and women playing the same video game (Hoeft, Watson, Kesler, Bettinger, & Reiss, 2008). While the authors infer likely sex differences in brain functioning related to the neural processes surrounding reward, other research establishes basic gendered differences in motivations for play (Klimmt, 2009; Lucas & Sherry, 2004), which may ultimately predispose men and women to differing degrees of problem use based on higher male participation in online gaming in general (Beutel et al., 2011) and preferences for distinct game styles (Mentzoni et al., 2011).

In a large study of media use among 8-18 year-olds in the US, a significantly smaller proportion of white youths (8%) reported playing more than an hour of video games the day previous than their black and Hispanic counterparts (14% and 13%, respectively; Roberts & Foehr, 2004). Given the correlation between hours used and problem video gaming behavior across a number of studies (see reviews in: Kuss & Griffiths, 2012a; Kuss & Griffiths, 2012b; Sim, Gentile, Bricolo, Serpelloni, & Gulamoydeen, 2012), these trends may reflect differential vulnerability to problem use by race/ethnicity. Differential hazards of negative consequences related to behaviorally “addictive” activities have already been well established in gambling research: Lang and Omori (2009) found that poor households lose a higher proportion of their income than wealthier households from lottery ticket purchases. They also found that African-American households, while being less likely overall to gamble, lost three times as much money as households headed by other races or ethnicities when they did gamble. Welte et al. (2002) found that African-Americans, Latinos, Native Americans, and Asians (2004) were more likely than whites to be pathological gamblers. Several additional studies (Cunningham-Williams, Cottier, Compton, & Spitznagel, 1998; Cunningham-Williams et al., 2004; Cunningham-Williams, Ostmann, Spitznagel, & Books, 2007) describe the comparatively higher problem gambling risk for African-Americans than for whites. Presuming some shared pathways between problem video gaming and pathological gambling, especially given the ubiquity of gambling mechanics across video game genres (King, Delfabbro, & Griffiths, 2010a), potential differences in PVGP prevalence corresponding to race/ethnicity warrant further investigation.

Similar effects concerning game preference and vulnerability to PVGP may also cluster around other important demographic variables. As a recent commentator on the concept of video game addiction has noted, extant research has focused largely on children and adolescents to the detriment of our understanding of age as a potential predictor of problem

use (Petry, 2011). Similarly, very little is known about socioeconomic determinants of problem use, such as education, employment status, and neighborhood characteristics. As one study demonstrated, metabolic changes (including systolic blood pressure and heart rate) resulting from playing the controversially violent game *Grand Theft Auto* were significantly greater for individuals with exposure to violence in their homes and communities (Brady & Matthews, 2006), indicating that complex ecological dimensions of socioeconomic status likely play important roles in how individuals experience distinct game titles or genres.

Study Hypotheses

In light of the concerns raised within the literature reviewed above and the clear gaps in our understanding about how, and among whom, problem video gaming develops, this study explores potential vulnerabilities to PVGP attributable to both gamer and game level differences. Additionally, the demographic constitution of audiences for distinct game genres is explored, adding to our current understanding of video game preference by gender, age, and race/ethnicity. Specifically, the study assesses the following hypotheses:

- PVGP will be significantly correlated with consumer involvement, number of days played in the past 30, hours/day on days played, and enjoyment of games.
- Game genre(s) played will explain significant variance in PVGP after controlling for demographic factors

Materials and Methods

Participants and Recruitment

This survey of video game playing adults (Elliott, Golub, Ream, & Dunlap, 2012; Ream, Elliott, & Dunlap, 2011a, 2011b) was administered by Knowledge Networks, an online research service provider, to a subset of a nationally representative panel. Panel members were recruited using probability-based, random-digit dialing and address-based sampling methods. Households were provided with internet access and home computers where required. To generate the study sample of adult video gamers, 15,642 e-mails were sent to panel members over 18, resulting in 9,215 (59%) completing a brief screener instrument. The screener asked whether participants “regularly,” “occasionally,” or “never” participated in 11 different leisure-time pursuits in the past year, including video gaming. Participants who reported occasional or regular video game play were subsequently asked to report hours spent playing video and/or computer games during the past 7 days. Those reporting one or more hours ($n = 3,380$, or 37%) were allowed to participate in the roughly 10 minute survey. This format was conducive to avoiding participant fatigue but required that several component measures be shortened.

Both the screener and the survey itself were administered in English and Spanish. Informed consent was established at the outset and the protocol approved by the authors’ respective IRBs. After completion, participants received “points” toward cash and other incentives offered by Knowledge Networks. Analyses in this study employ post-stratification weights provided by Knowledge Networks to more accurately reflect what would have been obtained from a true random sample of English- and Spanish-speaking American adults.

Video Game Genre

Survey participants were asked to enter up to five distinct game titles played during the past year. Of the 7,203 entries provided, 6,056 (from 2,885 participants) could be coded as distinct, valid titles. Coding and data cleaning resulted in a total of 1,335 different titles,

ranging in frequency of report from 1 to 340. Reported titles with insufficient accuracy of specificity to be assigned a distinct set of genre descriptors were discarded.

Existing genre categorizations from published research could not be utilized for the purposes of coding game titles submitted by survey participants due to the need to link recent game titles to distinct game genres systematically—rather than leave the task of making genre distinctions to project researchers. To this end, multiple online databases and archives containing similar genre information were considered. Ultimately project researchers decided to use the genre categories in the game archive at media conglomerate CBS' Gamefaqs.com, which was determined to be the most comprehensive database of its type. Higher-order genres like “shooter” were further divided according to subordinate descriptors supplied by gamefaqs.com (e.g., “first-person”) where adequate cell size (>30) for planned analyses permitted, resulting in the following categories:

- Action-Adventure (102 titles, 140 players): A broad category of games oriented toward action and exploration, mostly in third person perspective.
- MMO Role-Playing (30 titles, 99 players): Massively multiplayer online role-playing games in which players develop a character and interact collaboratively and competitively with other players in a shared online world.
- Other Role-Playing (91 titles, 117 players): Games rich in narrative, usually single player. Success depends largely on building a sufficiently powerful party of characters to achieve objectives.
- First-Person Shooter (101 titles, 266 players): Kill-or-be-killed in fast, violent action, usually with military or sci-fi themes.
- Other Shooter (45 titles, 31 players): Shooting type games in third-person perspective.
- Gambling (36 titles, 107 players): Primarily simulations of Poker, Black Jack, and Slot Machine gambling.
- Real-Time Strategy (41 titles, 56 players): Strategic combat oriented games from an aerial perspective with no wait between moves.
- Other Strategy (66 titles, 113 players): Turn-based (i.e., waiting on the player to act) and other forms of strategic simulation.
- Board/Card Games (61 titles, 502 players): Simulations of primarily classic games without gambling.
- Sports General (15 titles, 193 players): Primarily interactive motion-controlled sports and workout games.
- Sports (125 titles, 204 players): Realistic simulations, primarily of team sports.
- Puzzle (184 titles, 325 players): Games involving matching, logic, deductive reasoning, and other puzzles.
- Rhythm (20 titles, 65 players): Music and dance themed games often involving a unique controller like a guitar or dance pad.
- Driving (66 titles, 85 players): Primarily car racing games.
- Platformer (55 titles, 130 players): Games in two or three dimensions in which players contend with enemies in an environment requiring precision movement and jumping to achieve objectives.

- Other Genres (297 titles, 296 players): Titles that were distinct but did not belong to categories large enough for valid analyses (e.g., fighting, survival-horror).

The Board/Card Games genre was renamed from “Board Games,” as the category encompassed board games like chess and checkers and non-gambling card games, including hearts, pinochle, and solitaire.

Problem use of video games

This study employed an adapted version of the 9-item problem video game play (PVGP) scale, which was originally derived from substance abuse and pathological gambling criteria from DSM-IV (leaving out irrelevant constructs) and validated with a sample of Spanish adolescents (Tejeiro Salguero & Bersabé Morán, 2002). Response choices for PVGP were on a 5-point Likert scale from “not at all true” to “extremely true,” so that anyone scoring anywhere above the lowest possible value for the scale endorsed at least some degree of problem use. For another, closely-related study (Ream, Elliott, & Dunlap, 2011c), this scale was edited by splitting the longest, double-barreled (Dillman, 2000) item into two questions for a total of 10 items. Data from the study's first 114 cases (all that were available at the time of measure construction) were used to actor-analyze the measure and select the five items most highly correlated with a latent construct of PVGP. All four estimation methods in STATA 11.0 – principal factor, principal components factor, iterated principal factor, and maximum likelihood estimation – yielded the same five highest-loaded factors, and were included in the present study's survey, Cronbach's $\alpha = .74$.

Video game consumer involvement

Personal engagement in video gaming as a meaningful locus of pleasure, self-identification, and self-expression was measured using a 3-item Consumer Involvement Profile (Laurent & Kapferer, 1985), as refined by Wiley et al (2000) and Gursoy & Gavcar (2003) and edited for this survey to address video game use, $\alpha = .74$.

Game-level variables: Enjoyment, hours played, and days played

These were single-item indicators. Enjoyment of individual game titles was assessed via a single-item, 7-level Likert scale ranging from “It was the worst game I've ever played” to “It was my single all-time favorite.” Hours played was assessed with a single question: “In just the past 30 days, on days that you played [name of game in question], how many hours per day did you play?” The question for days played was “In just the past 30 days, on how many days did you play [name of game in question]?”

Demographic controls

For all participants, race/ethnicity, gender, age, income, education, employment, and metropolitan statistical area (MSA) resident status were assessed. Income was categorized into increments capped at “\$175,000 or more.” For the purpose of the following analyses, participants were coded as unemployed whether laid off, disabled, retired or otherwise not working.

Approach to analysis

All analyses employed post-stratification weights provided by Knowledge Networks to more accurately reflect what would have been obtained from a true random sample of English- and Spanish-speaking American adults. Tables 1 and 2 employ weighted bivariate OLS or logistic regression analyses, and table 3 reports results of a weighted correlation matrix. Table 4 describes results of three weighted hierarchical linear models run in MPlus 6.0 to predict game-level variables of days played, hours played, and enjoyment, and two weighted

nested OLS regression models to predict person-level variables of consumer involvement and problem video game play. Action-adventure was the reference category for genre in the game-level analyses, and its indicator was also left out of person-level analyses so that the interpretation of coefficients would be as similar as possible between game-level and person-level analyses. In Table 4, the row for person-level variance reflects the between-level R^2 from multi-level models for game-level variables and the R^2 from the reduced, demographics-only stage of nested OLS regression models for person-level variables. The row for game-level variance explained reflects the within-level R^2 from multi-level models for game-level variables and the R^2 change from adding the genre indicators to the nested OLS regression models for person-level variables to create the full, augmented models. With respect to both modeling techniques employed, the coefficients from the row for person-level variance explained test the hypothesis that genre explains unique variance.

Results

Description of the sample

The valid sample was 42% female, 69% white, 11% Black, 13% Latino, 4% Asian, 2% Native, and 2% multiracial or other (corresponding unweighted percentages are 43% female, 75% white, 8% Black, 11% Latino, 2% Asian, 1% Native, 4% Other). Mean age was 40 years (unweighted: 45), age ranged from 18 to 95, mean income category was 10, corresponding to \$35,000 to \$39,999 (unweighted: 11, corresponding to \$40,000 - \$49,999), and 86% lived in a metropolitan statistical area (MSA; unweighted: 85%). The following remained unchanged by sample weights: 58% were currently employed and mean educational achievement corresponded with “some college, no degree.” Participants provided data on an average of 2.1 games.

Basic relationships among study variables

Significant differences between past-year participants and non-participants in any given game genre were assessed by testing for significant differences in each demographic variable using OLS regression or weighted linear or logistic regression. Table 1 reports basic characteristics of the valid sample of video gamers and demonstrates significant demographic contours in video game usage by genre. Among video gamers age 18 and older, those reporting past-year use of many genres had mean ages between 30 and 35, with MMORPG, FPS, rhythm, RPG having the youngest audiences. Gambling and board/card games had mean player ages in the 50's, with puzzle games close behind. Women gravitated toward puzzle games, board/card games, platformers, and interactive sports-general games (predominantly interactive fitness or casual (non-simulation) sports games on the Nintendo *Wii*). Conventional sports games, role-playing games, shooters, and real-time strategy gamers showed extremely low female participation by comparison. The highest affinity among white participants was for role-playing and strategy games; among Blacks, for gambling and sports games; and among Latino gamers for platformers. The highest levels of education and income were found among players of general sports games and real-time strategy games, while the lowest were among gambling and platformer games. Non-working participants reported high incidence of gambling and board/card game use and low participation in the general sports genre. Variation association with MSA residence was marginally significant.

Table 2 describes basic differences in the dependent videogame playing variables based on participants' reported game play by genre and categorical demographic variables. To compare the incidence of problem use by genre, the percentages of participants reporting PVGP symptomatology in the 90th percentile or above are tabulated in the table's final column.

Four genres were positively correlated with PVGP—both role-playing genres (MMO's and Other RPG's) and both shooter genres (first-person and otherwise). Notably, video game playing variables were not necessarily all high or low for every genre. Puzzle games, for example, were characterized by relatively high reports of days used in the past month but a relatively low number of hours on days used, as well as low enjoyment and consumer involvement scores.

Table 2 also demonstrates the differential distribution of PVGP (and other game play variables) by racial and socioeconomic census categories. Males had modestly higher PVGP scores than females. Black gamers played for longer periods on days they played, enjoyed their games more, and felt more personally involved with video games than their white counterparts. Asians played on the most days in the past 30, while Native Americans played for the greatest length of time on days played. Asians, Native Americans, and Blacks all reported significantly higher degrees of problem gaming than Whites. Being employed was negatively correlated with PVGP.

Table 3 describes bivariate correlations among continuous study variables, including video game playing indicators and continuous demographic variables. Education and income were negatively correlated not only with those variables that could indicate use of video games as a diversion from daily hassles or stress (consumer involvement and PVGP), or with those that could indicate a relatively higher amount of free time (hours/days used), but also with all other video game playing indicators. The relationship of age to video game playing reflects perhaps a qualitative difference between younger and older adults' gaming habits: older gamers played for few hours at a time and experienced less engagement, enjoyment, and problem play, but played more regularly, i.e., for a higher number of days in the past month. The right portion of the table reflects the intuitive finding that all video game playing indicators are significantly correlated.

Tests of study hypotheses

Table 4 presents results of multivariate analyses testing the hypothesis that dimensions of videogame play vary significantly based on genre independently of demographic variables. Genre uniquely explains significant variance in all five dependent variables. They also, in the absence of results from an actual canonical correlation analysis with mixed levels of dependent variables (which would be unworkably complicated), provide some insights into which genres and demographic indicators predict which game playing variables and not others. Some differences between patterns of findings for days played, hours on days played, and enjoyment between table 2, which operationalized these variables as person-level, and table 4, which operationalized them as game-level, are worth noting. The games that were robustly regularly used were MMORPG's, gambling, other strategy, board/card, and puzzle games. Board/card games had the additional distinction of being relatively not enjoyable, although the mean level of enjoyment attributed to them was still above the scale mean of 4. The distinctions of consistent high consumer involvement and problem play went to MMORPG's, other RPG's, and first-person shooters. Within the multivariate analyses, real-time strategy and other shooters were high on consumer involvement without being remarkably high on PVGP, while board/card and puzzle games were high on PVGP but not high on consumer involvement.

Demographic variables also exhibited some interesting contrasts between bivariate and multivariate findings. Females played games for fewer hours, but enjoyed them more, and gender differences in consumer involvement and PVGP did not emerge as significant in the multivariate context. Other robust findings were that blacks were particularly high while Latinos were particularly low on consumer involvement, and blacks derived more enjoyment from video games. Unlike in the bivariate context, education, income, and

employment status were unrelated to hours on days played and game enjoyment. Their only significant relationships were with days played, consumer involvement, and PVGP.

Discussion

Summary

Study results confirmed initial hypotheses that aspects of video game playing behavior—ranging from days and hours played to enjoyment of particular games and personal involvement with video games generally—vary significantly based on the genre of the video game, even after controlling for demographic factors related to both genre and patterns of video game use. Consistent with hypotheses, genre explained significant variance in PVGP after controlling for other study variables. Genre also explained significant variance in the number of days played in the past 30, hours/day played, game enjoyment, and consumer involvement, and the sets of genre and demographic variables that were significantly independently associated with them were distinct from each other and from the set that was significantly independently associated with PVGP.

Published literature cited in this paper's background section suggests a likely interpretation for study findings about the MMORPG genre. The literature implicates a series of “addictive” game mechanics or design elements including: 1) the never-ending nature of the game (Boellstorff, 2008); 2) the presence of highly desirable in-game items (e.g., swords, armor or blueprints/recipes to make one's own gear or magic spells) that “drop” from slain enemies only extremely rarely (Castronova, 2005); 3) the social organization of in-game groups or “guilds” around daily repetition of lengthy activities, described by Hsu et al. (2009) as “belonging” and “obligation”; and 4) the paid monthly membership that encourages getting the most from one's gaming dollar (Castronova, 2005). The status of the violent first-person shooter (FPS) as conducive to problem use, on the other hand, is far less established in the popular and academic discourse on video gamers. The FPS genre's place as a new American pastime is evident in sales figures of blockbuster series like *Call of Duty* and *Halo* (D'Angelo, 2012; Parker, 2011, respectively), but this alone is hardly grounds for explaining the FPS game's position alongside MMORPGs as the most problem-oriented of the 16 genres examined. While one might reasonably infer that the online interactivity provided by these two genres may underwrite their associations with problem use, evidence of other critical game design elements impacting problem use was also found.

Other role-playing games (a category constituted almost entirely of titles played offline) were also significantly linked to problem use, suggesting that online personal interaction constitutes only part of the “addictive” component of the MMORPG genre, and may in fact be overshadowed by character development, narrative, and economic activity—all dimensions of both on- and offline role-playing games. Gambling games were correlated with higher than average report of problem use, likely for reasons well studied and understood in the classic language of operant conditioning through variable interval reinforcement. For the gambling game titles reported, however, it is important to note that (based on the titles submitted by participants) most were determined to be pure simulations that did not facilitate actual, real-money wagers—further evidence that the mechanics and materiality of (virtual) reward in video games ought not necessarily be seen as intrinsically different from real-world, monetary reinforcements as studied in gambling research (King, Delfabbro, & Griffiths, 2010a).

Video gaming (of certain types) has been shown to have varying effects by gender on neural activity and arousal. In our findings, being a female gamer was associated with greater enjoyment of games played, lower involvement, and fewer hours on days played, but sex ultimately bore no discernible protective effect vis-à-vis problem use in our study. This

suggests that problem use susceptibility may be more readily linked to gendered patterns of socialization (Lucas & Sherry, 2004) by which males and females gravitate toward game genres with differing problem use potential than to intrinsic, sex-determined differences in brain functioning as has been previously claimed (Hoeft, Watson, Kesler, Bettinger, & Reiss, 2008). Similarly, strong bivariate correlations between Black race and all game-level dependent variables dropped out in the multivariate model, rendering the disproportionate level of problem game use for Black/African-American gamers a problem grounded primarily in socioeconomic and educational disadvantage, game genre predilection—gambling games chief among them—and potential factors lying beyond the scope of the study. Perhaps the preference for gambling games is simply an extension of the aforementioned demographic findings; as African Americans are more likely to be problematic gamblers (Cunningham-Williams, Grucza, Cottler, Womack, Books, Przybeck, Spitznagel, & Cloninger, 2004; Lang & Omori, 2009; Welte, 2004, 2002), factors contributing to their higher rates of problem gambling may also contribute to their being problem gamers (Welte, Barnes, Wieczorek, & Tidwell, 2004). Notably, African-Americans scored relatively high on measures of consumer involvement and gaming enjoyment, and consumer involvement was also related to lower levels of education, income, and employment. These factors potentially play an interactive role in the higher-than-average levels of problem gaming among African-Americans. The social, cultural, and psychological contexts in which Asians more readily experience problem video gaming symptomatology, on the other hand, cannot be meaningfully interpreted based on existing literature and must remain a topic for future research.

Limitations

Given the limitations of a 10-minute cross-sectional survey instrument, the study could not assess hypotheses that preferences for particularly “addictive” game genres like the FPS, for example, are concentrated within individuals exhibiting relatively high degrees of impulsivity, sensation seeking, or other traits shown to be predictive of substance abuse and/or pathological gambling. Should these personality/game preferences be established in future research, it will remain to ask whether game genre preference maintains a unidirectional or transactional relationship with personality and what developmental, state or trait factors—or market forces—influence the evolution of genre preference through the life course.

Future research

These findings suggest several important directions for future research drawn speculatively from the genres that have been shown to be predictive of higher degrees of PVGP. The first involves more careful study of the ways in which different genres may require players to carefully craft their own (virtual) identities and how that process impacts the “addictiveness” of games featuring it. In the case of role-playing games both online and offline, character development, appearance, and narrative trajectory lie increasingly in the hands of the player, providing at least the promise of a pleasurable fit with (or meaningful deviation from) real-life personhood. For the FPS game, it bears asking whether the first person perspective itself may be a critical variable in player involvement, immersion, and problem use, or whether realistic violence and interpersonal competition (via local area network or internet) more readily preconditions FPS gamers to the higher degrees of problem use symptomatology identified here.

The role of consumer involvement as a driver of PVGP is also unclear. Only three genres were found to have high levels of both PVGP and consumer involvement in the multivariate analysis: MMORPGs, Other RPGs, and FPS games. Significantly higher than baseline consumer involvement (without corresponding elevation in PVGP) was observed in RTS,

other shooter, and team sports games, and board/card and puzzle games were associated with only PVGP despite their players' relative lack of consumer involvement. Consumer involvement was also correlated with lower educational attainment, lack of employment, and lower income level, suggesting the importance of further inquiries into consumer involvement, genre preference, and PVGP for gamers from lower socio-economic strata. Finally, the role of personality in game genre preference remains an important open question for ongoing research. While the addictive personality hypothesis has largely fallen from scientific favor, game genre may ultimately mediate causal relationships between personal characteristics such as sensation seeking or impulsivity and problem video game play.

Conclusions

Broader etiological and epidemiological questions aside, this study has provided important indications about the demographic concentration of problem use as well as the disproportionate experience of problem gaming among players of a small subset of contemporary game genres. Currently, legislation regulating the video game industry and warnings about video game related risks operate almost exclusively at the level of game content as determined by the ESRB. In light of the findings presented here, it seems fair to say that video gamers might productively be educated about the structural differences between contemporary game genres that go beyond the content areas identified in a game's rating. Regulatory change leading to this sort of informational development may be highly contested by the industry and ultimately slow to emerge. Even in its absence, however, further research and educational outreach geared toward educating video gamers and their parents about games' structural dimensions and reward schemes would demonstrate a much needed public health concern with problem video game use, whatever its ultimate clinical designation.

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Table 1
Basic associations between demographic characteristics and whether participants reported playing specific genres

	N	Wtd %	Age	Female Gender	Race:					Educ. Cat.	Income Category	Non-MSA	Not Working
					White	Black	Latino	Asian	Native				
Action-Adventure	384	13%	33	21% ^{***}	63%(ref)	13%	14%	4%	2%	10.2 [*]	10.4	13%	40%
MMO Role-playing	138	5%	31	19% ^{***}	81%(ref)	1% ^{**}	6%	4%	2%	10.1	11.0	13%	38%
Other role-playing	240	8%	32	28% ^{***}	79%(ref)	4% ^{***}	6%	4%	3%	10.3 ^{***}	10.8	14%	42%
1st-person shooter	522	18%	31	15% ^{***}	69%(ref)	9%	14%	4%	1%	9.9	10.9 ^{**}	13%	35% ^{***}
Other shooter	104	4%	34	15% ^{***}	74%(ref)	12%	8%	1%	3%	9.6	9.8	15%	47%
Gambling	155	5%	53	43% ^{***}	66%(ref)	18% ^{**}	10%	1%	1%	9.3 ^{***}	9.2 ^{***}	14%	60% ^{***}
Real-time strategy	125	4%	33	11% ^{***}	81%(ref)	3% ^{**}	6%	4%	2%	10.7 ^{***}	11.5 ^{**}	11%	34%
Other strategy	171	6%	40	38% ^{***}	81%(ref)	2% ^{***}	4% ^{***}	7%	2%	10.3 [*]	11.2 [*]	14%	38%
Board Games	565	20%	55	57% ^{***}	74%(ref)	11%	8% ^{***}	5%	1%	10.3 ^{***}	10.3	18% [*]	54% ^{***}
Sports-General	295	10%	38	56% ^{***}	76%(ref)	9%	8% ^{**}	6%	1%	10.6 ^{***}	12.0 ^{***}	15%	24% ^{***}
Sports-Other	408	14%	35	16% ^{***}	63%(ref)	20% ^{***}	12%	1% [*]	2%	10.0	10.4	10% [*]	34% ^{***}
Puzzle	447	16%	49	73% ^{***}	73%(ref)	10%	10% [*]	4%	0.4% [*]	10.0	10.4	17%	45%
Rhythm	156	5%	32	47% ^{***}	77%(ref)	5% [*]	10%	3%	2%	10.2	11.1 [*]	8% [*]	38%
Driving	207	7%	34	36% ^{***}	73%(ref)	8%	12% [*]	1%	4%	10.0	10.5	14%	36%
Platformer	267	9%	35	54% ^{***}	62%(ref)	7%	27% ^{***}	3%	1%	9.6 ^{**}	9.9 [*]	18%	34% ^{**}
Unclassified	618	22%	39	46% [*]	66%(ref)	15% ^{**}	13%	4%	1%	9.9	9.9 ^{**}	14%	42%
Overall	2885	40	42%		69%	11%	13%	4%	2%	9.9	10.4	15%	42%

Note: N adds up to more than 2885 and weighted % within sample totals more than 100% because most participants reported on multiple game genres. Tests of differences in means/proportions between participants who report playing a genre and participants who do not significant at:

*
p < .05

**
p < .01

p < .001.

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Table 2
Bivariate relationships of genre and categorical demographic factors with game playing variables

Game-Level Variables (avg. within person)							Person-Level Variables		
	Days Used in Past Month	Hours on Days Used	Enjoyment	Consumer Involvement	Problem Playing	Prob. Play >90%ile			
Game genre (coded as 1 if played in past month, 0 if not, some participant name multiple genres)	Action-Adventure	8.0***	3.0*	5.32*	2.49***	1.75***	19%***		
	MMO Role-playing	11.6*	3.4**	5.33	2.84***	1.82***	18%*		
	Other role-playing	6.7***	3.0*	5.28	2.62***	1.79***	23%***		
	First-person shooter	8.4***	3.1***	5.37***	2.53***	1.82***	23%***		
	Other shooter	7.6**	2.6	5.09	2.60***	1.79***	24%***		
	Gambling	14.1***	2.7	5.17	2.19	1.64	17%		
	Real-time strategy	9.0	3.4**	5.15	2.55***	1.68*	14%		
	Other strategy	11.7**	2.6	5.14	2.25	1.62	12%		
	Board/Card Games	13.2***	2.2**	4.96***	1.94***	1.52	9%**		
	Sports-General	6.6***	2.2*	5.34*	1.98***	1.40***	6%**		
	Sports	8.0***	2.7	5.23	2.25**	1.53	10%		
	Puzzle	11.4***	2.0***	5.04***	1.96***	1.56	10%		
	Rhythm	5.4***	2.2	5.28	2.18	1.46*	8%		
	Driving	5.9***	2.3	5.15	2.11	1.49	11%		
	Platformer	6.4***	2.3	5.21	2.10	1.51	9%		
	Unclassified	9.4	2.7	5.17*	2.20	1.62**	15%**		
Gender	Male	9.5*	2.8***	5.19**	2.23***	1.58*	12.7%		
	Female	10.2	2.4	5.30	2.03	1.53	10.6%		
Race	White	9.9(ref)	2.4(ref)	5.21(ref)	2.12(ref)	1.53(ref)	11%(ref)		
	Black	9.3	3.2***	5.44***	2.38***	1.64**	16%*		

Game-Level Variables (avg. within person)				Person-Level Variables			
	Days Used in Past Month	Hours on Days Used	Enjoyment	Consumer Involvement	Problem Playing	Prob. Play >90%ile	
	Latino	9.3	2.9**	5.24	2.02*	1.54	10%
	Asian	12.2**	2.2	5.14	2.18	1.73**	14%
	Native	9.2	4.4***	5.30	2.44*	1.78**	20%
	Other	7.9	2.7	5.12	2.20	1.64	12%
MSA Residence	MSA Resident	9.7	2.6	5.23	2.15	1.56	11%*
	Non-MSA Resident	10.2	2.6	5.24	2.10	1.56	15%
Working	Working	8.6***	2.4***	5.22	2.10**	1.50***	10%***
	Non-working	11.4	2.8	5.26	2.20	1.64	15%
	Overall	9.8	2.6	5.23	2.1	1.56	12%

Tests of bivariate association significant at

* p < .05

** p < .01

*** p < .001

/ Reference Category

Table 3

Bivariate correlations among demographic and video game playing variables

	Person-Level Variables				Game-Level Variables (avg. within person)	
	Age	Education Category	Income Category	Consumer Involvement	Problem Playing	Days Played in Past Month
Education Category	0.04 [*]					
Income Category	0.02	0.41 ^{***}				
Consumer Involvement	-0.18 ^{***}	-0.07 ^{***}	-0.11 ^{***}			
Problem Playing	-0.13 ^{***}	-0.09 ^{***}	-0.12 ^{***}	0.57 ^{***}		
Days Used in Past Month	0.22 ^{***}	-0.13 ^{***}	-0.11 ^{***}	0.21 ^{***}	0.28 ^{***}	
Hours on Days Used	-0.08 ^{***}	-0.11 ^{***}	-0.09 ^{***}	0.22 ^{***}	0.26 ^{***}	0.15 ^{***}
Enjoyment (game-level)	-0.13 ^{***}	-0.05 ^{**}	-0.05 [*]	0.18 ^{***}	0.16 ^{***}	0.14 ^{***}

Pearson r significant at + p < .10.

* p < .05

** p < .01

*** p < .001.

Table 4

Effects of game genre and demographic variables on dimensions of video game playing

	Game-level variables			Person-level variables		
	Days Used in Past Month	Hours on Days Used	Enjoyment	Consumer Involvement	Problem Playing	
Game genre ("within" level of multi-level model; Action-Adventure is reference category in multi-level model and left out of OLS models for ease of comparison)	MMO / Role-playing	7.44***	0.99 ⁺	0.23	0.59***	0.20***
	Other role-playing	0.43	0.60 ⁺	0.18 ⁺	0.39***	0.19***
	First-person shooter	1.28 ⁺	0.12	0.02	0.40***	0.31***
	Other shooter	-0.28	-0.32	-0.39*	0.28**	0.13 ⁺
	Gambling	4.35***	-0.08	-0.19	0.21*	0.17**
	Real-time strategy	3.29**	0.68	0.07	0.27**	0.07
	Other strategy	4.49***	0.28	-0.20	0.13 ⁺	0.09
	Board/Card Games	5.40***	-0.13	-0.36***	0.02	0.10*
	Sports-General	-0.01	-0.19	-0.06	0.02	-0.01
	Sports-Other	1.05	-0.17	-0.12	0.14*	0.02
	Puzzle	4.49***	-0.22	-0.18 ⁺	0.00	0.10*
	Rhythm	-0.77	-0.62*	0.01	0.08	-0.07
	Driving	-1.13	-0.72*	-0.22 ⁺	-0.02	-0.05
	Platformer	-0.58	-0.52 ⁺	-0.12	0.06	0.01
	Unclassified	1.54 ⁺	-0.24	-0.19 ⁺	0.13**	0.12***
Demographic s ("between" level of multi-level model; reference category for race is white)	Age	0.06***	-0.01 ⁺	-0.004*	-0.003*	-0.004***
	Gender: Female	-0.64	-0.39*	0.15**	-0.07 ⁺	-0.01
	Race: Black	-0.52	0.70 ⁺	0.22*	0.23***	0.05
	Race: Latino	-0.08	0.46	0.10	-0.14*	-0.03
	Race: Asian	2.35	-0.11	-0.08	0.12	0.21**

	Game-level variables			Person-level variables	
	Days Used in Past Month	Hours on Days Used	Enjoyment	Consumer Involvement	Problem Playing
Race: Native	0.05	1.65	-0.02	0.22	0.21 ⁺
Race: Other	-2.08 [*]	0.32	-0.07	-0.06	0.01
Education	-0.42 ^{**}	-0.11 ⁺	-0.01	-0.02 [*]	-0.02 ⁺
Income	-0.13 ⁺	-0.02	0.00	-0.02 ^{***}	-0.01 ^{**}
Non-MSA ² Resident	-0.22	-0.02	0.04	-0.03	0.01
Unemployed	1.39 ^{**}	0.21	0.03	0.06	0.11 ^{***}
Intercepts	6.61 ^{***}	2.74 ^{***}	5.27 ^{***}	1.94 ^{***}	1.39 ^{***}
Variance explained:					
Person-level ³	0.12 ^{***}	0.05 ^{**}	0.05 [*]	0.07 ^{***}	0.05 ^{***}
Game-level ⁴	0.10 ^{***}	0.02 [*]	0.03 ^{***}	0.08 ^{***}	0.06 ^{***}

¹Massively Multiplayer Online

²Metropolitan Statistical Area

⁺ p < .05

^{*} p < .01

^{**} p < .001

^{***} p < .0001.

³Reflects between-level variance in hierarchical linear models predicting game-level variables or variance explained by demographics only in nested OLS regression models predicting person-level variables.

⁴Reflects within-level variance in hierarchical linear models predicting game-level variables or additional variance explained by adding genre indicators to nested OLS regression models predicting person-level variables.