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Video Game Addiction: Truth or Fiction

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Abstract

Video game addiction is a phenomenon that is currently being researched to determine its clinical merit as an addiction disorder. Prior research places video game addiction in the category of behavioral/technological addictions. Experts hypothesize that video game addiction occurs as a result of physiological arousal while playing video games. Measures of physiological arousal (heart rate, blood pressure) were used in this experiment to determine whether video game play increased arousal. Results show a significant increase in heart rate, but not blood pressure, for those exposed to video games for ten minutes. It is not yet clear whether video game addiction is related to arousal; this study concludes that physiological arousal is an observable fact that requires further study.

Video Game Addiction: Truth or Fiction

One of the most common medical definitions of addiction is the compulsive physiological and psychological need for a habit-forming substance, such as a psychoactive drug (Medterms, 2006). Addiction, in this sense, is a bodily reaction to a foreign chemical substance, which causes habitual or compulsive use of this particular foreign substance. Addiction is characterized by the abuse, or excessive use, of any substance leading to a chemical dependence, which causes a chronic need for the substance. Continued use of the addictive substance induces adaptive changes in the brain that lead to tolerance, physical dependence, uncontrollable craving, and often, relapse (Medterms, 2006). The necessary elements for understanding and diagnosing a clinical addiction, in its most common form, are abuse, dependence, and tolerance.

Of the many forms of addiction that exist, the most commonly studied and diagnosed addictions are addictions to drugs; including alcohol, amphetamines, cocaine, heroin, marijuana, and nicotine. It is possible that these types of addiction are more commonly understood and studied because of their prevalence and incidence in American society. The foreign nature of chemical substance abuse and the obvious external symptoms it causes such as, weight fluctuation, mood changes, and abnormal behavior, may also be factors in the widespread research of these addictions. Although it is somewhat less complicated to diagnose and study an addiction that has external features, which can be defined by the presence of a foreign substance in a person's body, there are non-substance related addictions that are becoming more widely studied.

Pathological gambling, for example, is a clinically recognized and accepted addiction that does not require the consumption of a foreign substance. The definition of pathological

gambling, as recognized and described in the DSM-IV includes criteria such as the repeated and unsuccessful efforts to control, cut back, or stop gambling, committing illegal acts to finance gambling, and jeopardizing a job or significant relationship due to a gambling habit. (Goudriaan, Oosterlaan, deBeurs, & van den Brink, 2005)

Pathological gambling is considered a behavioral addiction since a foreign substance is not required; instead, the addiction is centered on a specific behavior. Behavioral addictions, as described by Griffiths and Davies (2002), consists of the compulsive behavioral involvement in a particular activity, a lack of interest in other activities, association mainly with other addicts, and aversive physical and mental symptoms when attempting to stop the behavior. These addictions include pathological gambling, sex/pornography addiction, exercise addiction, and video game addiction.

Griffiths and Davies (2002) suggest that behavioral addictions are no different from substance related addictions in terms of the six core components of addiction. These core components of addiction are salience, mood modification, tolerance, withdrawal symptoms, conflict and relapse. Salience is achieved when a behavior becomes the most important activity in a person's life, and thus dominates his/her thinking. Mood modification refers to the subjective experience that is reported as a consequence of engaging in a behavior; this can be seen as a coping strategy; the behavior becomes a means of escape through feelings of intense arousal (feeling a "buzz"), or feelings of tranquility ("numbing"). Tolerance is the experience of requiring more time spent on a certain activity or behavior to achieve mood modifying effects. Withdrawal symptoms can be described as the unpleasant feeling or physical effects when a behavior or activity is discontinued or suddenly reduced. Conflict is the experience of discordance within human relationships or conflict with other activities such as work, hobbies,

school, and/or social life. Lastly, relapse is the tendency for repeated reversions to earlier patterns of the problem behavior or activity after periods of abstinence and control.

These core components of behavioral addiction are similar to the required components in chemical/substance abuse addictions. The fact that a behavioral addiction, like pathological gambling, has become widely recognized in the clinical community as a true addiction, through representation in the DSM-IV, widens the possibility for other behavioral addictions.

In addition to pathological gambling, possibilities for other behavioral addictions are currently being explored by professionals in the field of psychology. Addictions that are behavior-based, however, pose a challenge for researchers in the area of gaining empirical evidence. This study considers a possible behavioral addiction based on the excessive use of video games. The possibility of video game addiction, to date, has not been widely studied. Research in the field of potential video game addiction has been primarily explored by authors and professionals in foreign countries such as Japan, China, Spain, and England. The primary sources of literature in this study come from experiments done in the United Kingdom and Japan.

The research done by Griffiths and Davies (2002) in their article entitled “Does Video Game Addiction Exist?” isolates a possible form of behavioral addiction that is focused on the use of technological devices. Technological addiction is defined as a non-chemical behavioral addiction that involves excessive human-machine interaction; either passive (television watching) or active (computer game playing) and usually contain inducing and reinforcing features that may contribute to promotion of addictive tendencies (Griffiths & Davies, 2002). Examples of technological devices and services, which are possibly addictive, include: television, video games, computer games, and the Internet. These technological addictions are viewed as a subset of behavioral addictions.

The particular technological addiction in question is the use of video games. Historically, video games and their effect on behavior have not been widely studied, partly due to their fairly recent invention in the 1970s. For this reason, there is little current research on this topic; however, of the research that has been completed, some articles feature research on video game addiction compared to pathological gambling addictions. One such example was published in the 1991 *Journal of Adolescence*, “Amusement machine playing in childhood and adolescence: A comparative analysis of video games and fruit machines”. This article, authored by Griffiths, provides useful information about the link between video games and gambling; however the actual games that it is based on have become obsolete.

In order to provide a basis for the study of video game research, one can review the physical and psychological similarities between slot machine gambling and video game play. Both video game machines and slot machines fall under the generic label of “amusement machines”. The primary difference between video game machines and slot machines is that video games are played to accumulate as many points as possible, whereas slot machines are played to accumulate money (Griffiths & Davies, 2002). This fact is also a similarity, because regardless of whether a player receives points or money, both of these rewards serve to positively reinforce a particular behavior thus encouraging more of the behavior being exhibited. Some structural similarities between gambling and video game play outlined by Griffiths and Davies (2002) include response to stimuli, requirement of total concentration, hand-eye coordination, auditory and visual rewards for “winning” moves, provision of incremental rewards for “winning” moves, reinforcing correct behavior, opportunity for competition, and peer group approval.

The important relationship between video game play and gambling is found in other structural features, such as the geographical place where the two behaviors occur. In the past, video game play and gambling were both activities that occurred outside of the home, either in an arcade or at a casino. However, with the current technological advances, video games can be played via the Internet or on home consoles. This is also the case with gambling; gambling can occur via the Internet with the use of credit cards, or even at restaurants and sports bars with video gambling stations.

Although there are many similar features between video game playing and gambling, differences do exist. Griffiths and Davies (2002) state that the outcome of video game play is mostly due to the skill of the player, while the outcome of slot machine gambling is solely due to chance. In the case of video games, a player can continually practice gaming, thus sharpening a particular skill in order to enhance performance and gain more rewards (points). Contrarily, slot machine gambling and video gambling success are primarily due to chance; the outcome of each trial will have absolutely no effect on the success of the next trial on a gambling machine.

The relationship and the similarities between gambling and video game playing provide a basis for the study of video games as a possible behavioral addiction. Before further examining this topic, it is necessary to understand why the study of video games is important and necessary to the field of psychology.

The widespread use of video games in the United States and abroad provides warrant for research in the area of possible video game addiction. The popularity of video games has greatly increased since their invention in the 1970s. Video games can now be played using: the Internet, computers, portable gaming devices, home consoles, and cellular phones. Statistics reveal that the 7.3 billion dollar video game market has more than doubled in the United States since 1996.

(Entertainment Software Association, 2006) On average, each household in the US owns at least two video games, yielding sales of 248 million computer and video games in 2004 alone. There is no doubt that video games are a fairly recent phenomenon whose presence has become a major part of American life; this fact reveals that video game research is needed in the US and around the world.

Despite the increasing popularity and widespread use of video games, there has not been extensive empirical research on the short and/or long-term effects of video game use. A search for current studies of video games and their effects on players can be found difficult. Studies conducted in the 1990s are no longer valid or relevant to the rapidly advancing technology of today's video game market. Articles such as Anderson and Ford's "Affect of the game player: Short term effects of highly and mildly aggressive video games" (1986) are based on video games that emerged in the early 1980s; it is a fact that current video games contain more intense violence, nudity, and profanity as compared to games created twenty years ago. This further illustrates that outdated technology is not always useful in current studies of video game addiction, although in some cases, the general principles of reward and reinforcement still hold.

Outdated research is considered unsound since the actual graphics, visual, and sound effects of video games have changed tremendously since their emergence in the 1970s. There has been current media coverage of the phenomenon of video game addiction, but these articles lack the empirical evidence to support these claims. Articles such as "Rehab not just for drugs anymore" (Phillips, 2006) states that video game addiction is a valid and verifiable addiction; the author presents useful knowledge and interviews of video game "addicts" but does not include an empirical basis for the statements.

Salguero and Moran (2002) have recently conducted research in the area of measuring problem video game playing in Spanish adolescents. This data shows that the study of possible video game addiction is lacking an empirical form of accurately measuring whether or not someone is addicted to video games. One serious problem with previous findings is the lack of well-validated diagnostic criteria for video game “addiction” (Salguero & Moran, 2002). This study states that the best way of achieving an objective way of diagnosing video game addiction is through adapting the diagnostic criteria for pathological gambling in the DSM-IV. Fisher (1995, as cited in Salguero & Moran, 2002) adapted the criteria for pathological gambling in the DSM-IV to provide a screening measure of addictive use of video games. If a person answered “yes” to four (or more) of the nine items of the questionnaire, the person was considered to be a potential video game “addict”.

Salguero and Moran’s (2002) data is focused on developing an accurate form of measurement for video game addiction. The result of their empirical research is the Problem Video game Playing Scale. This is a short scale of measurement of problem video game playing with dichotomous “yes/no” answers (Salguero & Moran, 2002). A questionnaire was also used that elicited the following information: demographic data, commitment to video games (frequency of playing during the previous year, mean and longest duration of play), type of video game systems (hand-held, home console, computer game, coin-operated arcade game machines), and assessment of the person’s own video game use with three dichotomous items (‘I think I play video games too much’. ‘I think I have some type of problem associated with my video game playing’ and ‘My parents are worried because they think I play video games too much’).

This study finds that the PVP Scale, as suggested by Salguero and Moran (2002), has a direct relationship to the Severity of Dependence Scale. The SDS is a well recognized scale used

for measuring dependence on different types of drugs with a focus on psychological variables. The direct relationship between the PVP and the SDS further demonstrates the construct validity of the PVP. Salguero and Moran (2002) also found that self-report scores were consistent with PVP scores; adolescents who reported high usage of video games also received higher scores on the PVP. The results of Salguero and Moran's (2002) study also show that males reported significantly higher frequency and longer mean periods of video game play when compared to females. A significant difference, however, was not found among adolescents of different ages. Younger adolescents did not differentially play more or less than older adolescents; no interaction effect was found between age and gender.

Salguero and Moran (2002) concluded that males play video games more regularly than females, and that the PVP Scale appears to be an acceptable scale of measurement for video game addiction. A duplicate of the PVP Scale can be viewed in Appendix B. It appears that the findings of Salguero and Moran (2002) support the hypothesis that, in some adolescents, video game playing is a behavior which resembles dependence. For these people, the behavior is out of their control, is invasive, is used as an escape from the reality or involves serious risks for their social development.

Although the results found by these authors seem promising, there is still not enough general research literature to establish that pathological video game playing is a legitimate and relevant problem in adolescent populations. The authors suggest that more clinical experiments and literature is needed. Longitudinal studies examining age variables and how they affect video game play are recommended, along with the study of long-term video game effects.

Additional research on the topic of video game addiction focuses on a teenage population in Taiwan. Chiu, Lee, and Huang (2004) performed an empirical experiment on a population of

1,228 students in grades 5-8, sampling from 20 schools in Northern Taiwan. Chiu et al. (2004) have recognized the growing trend of video game play among teenagers; their findings are very similar to other experiments in the field of video game addiction.

Findings by Chiu et al. (2004) attempted to determine whether the variables of sensation seeking, boredom inclination, family function, and gender have a significant effect on video game addiction. The first variable of sensation seeking is the inherent individual personality seeking excitement and changing experiences, new contexts and complexity, and desire for a kind of internal motivation (Chiu et al., 2004). This variable can be split into high sensation seeking personalities and low sensation seeking personalities. Results show that persons who exhibit high sensation seeking qualities may be more inclined to display video game addiction.

The next variable tested was boredom inclination; this is described as feelings of having excessive amounts of time with nothing constructive to do. Increased boredom inclination can lead to a desire to escape from reality. Teenagers and children who have no constructive plans for leisure time become bored, which may draw them to play games to kill time and indulge in the simulative and imaginative worlds of video games (Chiu et al., 2004). Results show that teens with higher boredom inclination are more likely to become addicted to video games. The variable of family function refers to the degree of how involved parents are in the lives of teens at risk for video game addiction. Results show that families that function with more parental oversight over education and recreational time have teens that are less likely to become addicted to video games. Lastly, the variable of gender reveals, like most other findings, that males are more likely than females to play and become addicted to video games.

Other topics addressed in the works of Chiu et al. (2004) include possible physical consequences of excessive video game play. Negative influences on physical and mental

functioning related to time spent on video games show that the games impacted sight and weight loss on the physical side, and confusion of reality and illusion and immature human relationships on the mental side (Matsushita & Matsushita, 1997, as cited in Chiu et al., 2004). This information suggests that spending numerous hours playing video games may affect eyesight by causing diminished vision. Also, the sedentary nature of video games can contribute to weight concerns; either weight gain, due to little physical activity, or weight loss, due to total preoccupation with video game play. There have been reports in popular news media articles that state that serious health concerns have come from video game play.

“Asia is most notorious for gaming addiction, where there have been cases of gamers going without food or water in order to finish a level or quest. Many gamers remember the South Korean man who died of heart failure last year, right after playing computer games non-stop for 50 hours.”(Phillips, 2006)

The work of Chiu et al. (2004) provides necessary literature and makes useful suggestions in the field of video game addiction research. The survey, using structural equation modeling, by Chiu et al. (2004) found results that add valuable empirical data to the field of video game research. If this area of study is to be considered, it is necessary for empirical research designs to be performed on this topic.

The empirical studies found in the field of video game addiction primarily use self-report measures and questionnaires to determine whether individuals display a problem with video game play. Unfortunately, the self-report approach is not the soundest way to determine an individual's status as an “addict”. For this reason, Griffiths has proposed that information about a person's arousal can provide a more statistically scientific and objective form of measuring video game addiction. Assessment of physiological arousal is an objectively measurable characteristic

of video game play that can be measured by assessing blood pressure, heart rate, or examination of the brain using functional magnetic resonance imaging (fMRI).

One theory reported by Griffiths (2005) is that video game addiction is a function of the video game's effects on arousal level, i.e., people who play video games to excess either do so for its arousing or tranquilizing effects. Other possible theories state that people who play games in excess are addicted to the escape or fantasy that is offered in video games, these people may have poor imaginations. Another theory states that excessive video game play is due to an individual's personality; individuals with a dependent or addictive personality may become addicted to video games.

Of the three theories stated, the one that is most able to be objectively measured and empirically studied is the theory of arousal. Recent research by Keopp et al. (1998, as cited in Griffiths and Davies, 2002) demonstrated dopaminergic neuro-transmission during video game play. The dopaminergic system has been accepted as a location in the brain that is highly correlated with reinforcement; it seems as though video game play arousal stimulates the reward center of the brain. If it is accepted that video game playing can be addictive, then it is appropriate to look for the neural foundation of such behavior (Griffiths & Davies, 2002).

There have been some studies and reviews which state that behavioral addictions do have effects on the brain that are similar to how substance abuse addictions affect the brain. "The experts are fond of saying that addiction occurs when a habit "hijacks" brain circuits that evolved to reward survival enhancing behavior...thus drugs are no longer the heart of the matter" (Holden, 2001). Since gambling is the most accepted form of behavioral addiction, studies of arousal and brain activity during gambling share similarities with brain function of alcoholics.

"A positron emission tomography study of pathological gamblers playing blackjack...showed significant changes in cortical arousal depending on whether they

were just playing cards or betting with a \$100 stake...it resembles another study showing alcoholics' brain reactions to looking at a bottle of Coke versus a bottle of whiskey" (Holden, 2001).

The understanding that there are similarities in the brain activity of substance-related addictions and behavioral addictions provides valuable information to the study of video game addiction. Keopp et al. (1998, as cited in Griffiths & Davies, 2002) have clearly demonstrated an increase in the release of dopamine within the ventral striatum (nucleus accumbens) as a function of video game playing (Griffiths & Davies, 2002). This chemical change occurring in the brain during video game play corroborates with the fact that behavioral addictions can stimulate the reward center of the brain similarly to how substance addictions stimulate the brain. Consequently, a way forward in studying behavioral addiction is to incorporate within a single model, psychological evidence on the behavioral repertoire of game addicts with the evidence concerning *in vivo* changes in the functional neurochemistry of the brain (Griffiths & Davies, 2002).

It has been established, through previous experimentation that a phenomenon entitled video game addiction is within the realm of possibility. The literature reviewed above demonstrates that the field of video game addiction requires more empirical research focusing on both psychological and physiological elements involved in video game addiction. Thus, the proposed experiment plans to rigorously test both psychological elements (through self-report and the PVP scale) and physiological elements (through measures of arousal) of possible video game addiction.

In a test of whether video game play increases arousal in players, it is hypothesized that all forms of video game play will increase physiological arousal as compared to baseline and control measures of arousal. Both experimental groups will demonstrate more physiological

arousal after playing video games as compared to a no video game control. The next hypothesis states that males will experience higher levels of arousal in all experimental conditions since research supports that males are more likely to play video games. Lastly, it is hypothesized that persons administered video games allowing high levels of violence without consequences, experimental group two, will display higher levels of physiological arousal, as compared to persons administered high-consequence video games, experimental group one.

Examination of psychological elements will be taken using self-report measures and will be used for comparison measures to help understand whether participants' ideas of video game use and the arousal displayed as a result of video game use are concurrent.

Method

Participants

The sample size for this study was determined by conducting a power analysis. A medium effect size was estimated due to the relatively scant information available from other similar studies. In order to detect a medium effect size (Cohen's $d = .5$), with $\alpha = .05$, and power = .80, approximately 20 participants per condition (total = 60) were used. Thirty men and 30 women were used (ten men and ten women per condition) to provide accurate representation for the male/female sex variable.

Participants were college students between the ages of 18 and 24 years. Individuals with high blood pressure conditions, abnormal cardiovascular conditions, and students over the age of 24 were excluded from this study. The age exclusion is due to the recent invention (1970s) and popularity of video games.

Students were recruited and registered for participation through the Public Applications Website for Students (PAWS), and received extra credit in their psychology courses for their participation.

Materials and Measures

The Video Game Status Questionnaire, adapted from Copeland's Smoking Status Questionnaire, was administered to determine demographics and information about current and past video game experience. Participants were split into either an experienced category or a novice category based on responses to this questionnaire. Participants who indicated playing video games everyday, having ever played video games everyday, having an average duration of video game use of at least one hour and a longest duration of at least three hours were considered experienced video game players. Previous experience with Need for Speed: Most Wanted and/or Need for Speed: Underground 2 was also be taken into consideration, but is not required for being considered an experienced video game player. The Video Game Status Questionnaire can be seen in Appendix A.

The Problem Video Game Playing Scale (PVP) is a short self-report scale that was administered to detect unhealthy video game use. The PVP scale was created by Salguero and Moran (2002) and is based on DSM-IV criteria for substance dependence and pathological gambling. A score of four or higher on this nine item dichotomous ("yes/no") scale indicates that a participant may be a potential video game "addict" or is at high risk for video game addiction. This scale has an internal consistency coefficient (Cronbach's alpha) that is acceptable for a nine item scale at 0.69. This scale asked subjects to report the occurrence of video game playing behaviors during the previous year. The PVP scale can be found in Appendix B.

These self-report measures were used for comparison purposes. Questions (9-10) on the Status questionnaire will be compared to overall score on the PVP to determine whether participants rate themselves consistently on questions of video game use. Scores on the Status questionnaire were also used as a form of comparison for the video game task. It is of interest to

know if individuals who are highly experienced with video game use will show more or less arousal in a video game task as compared to low experienced individuals.

Since it is hypothesized that physiological arousal is a potential reason why video games are addictive, physiological measures of arousal were taken while the video game task was administered. Depending upon group assignment, participants were exposed to a high-violence/aggressive, low-consequence video game stimulus, a mild/non-aggressive, high-consequence video game stimulus, or a no video game stimulus control. Each participant in an experimental (non-violent/violent) condition was required to play a particular video game for fifteen minutes. Physiological measures of arousal level were taken before, during, and after the video game stimulus administration in order to determine whether video games have an effect on physiological arousal level (as compared to baseline and control), and also to test whether violent video games with low-consequences cause more physiological arousal than mildly violent video games with high-consequences for violent actions.

Physiological measures of arousal used in this experiment were heart rate and blood pressure. Blood pressure was measured with a cuff. This device was used to measure participant blood pressure at baseline, after five minutes of play, ten minutes of play and after fifteen minutes of exposure to the experimental (or control) condition of the experiment. Heart rate and pulse were also measured at baseline, after five minutes of play, ten minutes of play, and after fifteen minutes of exposure to experimental condition. All research assistants were properly trained, by Psychological Services Center staff, in the correct use of blood pressure and heart rate measurement devices.

Video game task.

Video games chosen for administration in the video game task conditions were selected for their extreme similarities; the two games were created by the same publishing company and are based upon the same principle of automobile drag racing. The two video games are Need for Speed: Underground 2 and Need for Speed: Most Wanted. The major difference between the two games is the ESRB rating that each received; Most Wanted received a rating of Teen while Underground 2 received a rating of Everyone.

These games were evaluated by the Entertainment Software Ratings Board (ESRB). Game manufacturers are required to submit all video games for ESRB rating before they are marketed to the public. This review board provides ratings on the basis of violence content, sexual themes and suggestions, and profanity. ESRB provides rigorous examination of every video game before it is marketed. The process of certification is described by the professionals at ESRB.org.

To get a game certified with an ESRB rating, publishers fill out a detailed questionnaire explaining exactly what's in the game, and submit it to ESRB along with actual videotaped footage of the game, showing the most extreme content and an accurate representation of the context and product as a whole. Working independently, three trained raters then view the game footage and recommend the rating and content descriptors they believe are most appropriate. ESRB then compares the raters' recommendations to make sure that there's consensus. Usually, the raters agree and their recommendation becomes final. However, when the raters recommend different ratings, additional raters may be requested to review the game in order to reach broader consensus. Once consensus on a rating and content descriptors is reached, ESRB issues an official rating certificate to the game's publisher.

When the game is ready for release to the public, publishers send copies of the final product to the ESRB. The game packaging is reviewed to make sure the ratings are displayed in accordance with ESRB standards. Additionally, ESRB's in-house game experts randomly play the final games to verify that all the information provided during the rating process was accurate and complete. (ESRB.org, 2006)

The ESRB found that Need for Speed: Underground 2 has content that may be suitable for persons ages 6 and older. It contains minimal violence, some comic mischief and mild language. For this reason Underground 2 was rated E (for everyone). Need for Speed: Most Wanted was

found to contain content suitable for persons age 13 and older and contains violent content, mild/strong language and suggestive themes. This is why Most Wanted was rated T (for teen). (ESRB.org,2006)

Of the available video games that are useful for empirical comparisons, Most Wanted and Underground 2 were selected. Participants selected for the violent, low-consequence video game condition of the video game task played Most Wanted for fifteen minutes. In this game the player is a young man or woman working as a career drag racer. Rewards are provided to the racer for each race he/she wins. Rewards include, new cars, monetary gains in increments of \$10,000, and respect in the street racing world. Players are allowed to run other racers off the road, smash into light poles, and drive at 140mph all while being pursued by the police. During the course of this game there are no consequences for these actions; racers are not penalized for destroying things and can even earn money for causing damage to other cars and architectural structures. During this game the driver's car is never damaged, regardless of how many "accidents" are caused.

The game selected as the non-violent, high-consequence experimental condition of the video game task is Underground 2. In this game racers are also awarded cash prizes for winning races along with opportunities to upgrade his/her car. This game however, does not allow players to run off the road and penalizes drivers for crashing into other cars and objects. There is no opportunity to advance if the racer crashes or runs other cars off the road; in this game if a driver hits another car he/she must re-start the race. This game does not involve police chases.

Video game tasks were administered via an X-box 360. This video game home console was released by Microsoft in 2005 and is a member of the latest generation of video game technology. It includes features such as a DVD/CD player, video gaming capabilities, as well as

online game-play capabilities. This device was chosen due to its popularity in the gaming arena and also because it is a member of the latest generation of technology and will not become outdated until 2010.

The control condition in this experiment did not involve the playing of any video games. Participants were asked to perform a normal task that will not evoke physiological stimulation. Participants read Parenting Magazine January 2007 for fifteen minutes. This magazine was provided by the research assistant.

Procedure

Participants enrolled in the study through their PAWS account. They were greeted by a trained research assistant at the Psychological Services Center (PSC) in Johnston Hall. The research assistant asked each participant to read the consent form and answered any questions he/she had about the study. A signed copy of this form was collected and the participant was provided a copy for his/her own records.

Participants were then assigned to receive either level of the experimental condition or control condition protocol. After this is assigned, the questionnaires described above were completed, and then participants had their baseline physiological measures taken. Participants not assigned to the control condition were asked to complete a video game task for fifteen minutes. Participants assigned to the control condition read Parenting Magazine for fifteen minutes. All participants had their blood pressure and heart rate assessed every five minutes for fifteen minutes. Following the completion of each testing session participants were debriefed and points were administered.

In all levels of the experiment participants were administered the Video Game Status Questionnaire first, and then the PVP Scale was completed. In each condition, five-seven

minutes were allowed for the completion of these two self-report measures. Participants in each condition also had physiological arousal measured at baseline, five minutes, ten minutes, and fifteen minutes. Participants were each given equal amounts of time for task completion (15mins). Lastly, all participants in this study were debriefed at the conclusion of their individual experimental session.

The only difference in the protocol of testing sessions occurred during the task section. Individuals in the control group read Parenting Magazine during the ten minutes allotted for task completion. Individuals in the video game task conditions were informed of the objective of the video game and given instructions on how to operate the video game console. Participants were given a diagram outlining the buttons on the video game controller, and were allowed to refer to the diagram as often as needed. If participants asked any questions about how to play the game or about how the controller works, they were referred to the diagram. Diagrams of video game controls can be viewed in Appendix C and Appendix D.

Results

A total of 82 participants signed up for the study, of these, 61 attended the experiment, 18 were no-shows, and three had to be dropped. Of the three participants dropped, one person was dropped due to technical problems with the video game system that interfered with data collection; one person was dropped due to health conditions that prevented accurate participation; lastly, one person was dropped due to elevated blood pressure measures.

Of the participants in the study 30 were male and 31 were female; 73.8 % of this sample identified themselves as Caucasian, while 26.2% of the sample identified themselves as non-white, including Hispanic, African American, and Asian. The average age for both men and women was 20 yrs old ($M=20.13$, $sd=1.71$).

One hundred percent of participants reported having some type of contact with video game play on a home console, video arcade, computer games, hand-held portable device, or a cellular phone. Of these, 21.3% reported no present use of video games, 14.8% reported daily use, and 63.9% reported use of video games once or more each month. When asked about contact with the specific video games used in the experiment, 19.7% reported having played Need for Speed: Underground 2; while 18% reported having played Need for Speed: Most Wanted. When asked about duration of video game play, the average duration of use was found to be one hour ($M=1.01$, $sd=1.18$). The longest duration of use was found to be three hours ($M=3.08$, $sd=3.50$).

After participants completed the study they were all split into categories based on past exposure to video games as reported on the Video Game Status Questionnaire; these categories were experienced or novice. Participants who indicate playing video games everyday, having ever played video games everyday, having an average duration of video game use of at least one hour and a longest duration of at least three hours will be considered experienced video game players. Previous experience with Need for Speed: Most Wanted and/or Need for Speed: Underground 2 will also be taken into consideration, but is not required for being considered an experienced video game player. Of the participants in the sample 77% were novices, while 23% were experienced.

Participants also completed a nine-item dichotomous Problem Video Game Playing Scale as devised by Salguero and Moran (2002). A score of four or more “yes” answers on the scale represents a potential problem with video game playing. Of the participants in the study only 8.2% received a score indicative of a problem with video game use; 91.8% of participants received scores of three or below.

A chi-square test was used on the exposure to video games variable and the gender/sex variable. Of the participants in the experienced category 92.9% were male, while 7.1% were female, $X^2(1) = 13.87, p < .05$. A chi-squared test was also used on the exposure to video games variable and the experimental condition variable. This test found a well distributed number of novice and experienced participants in each level of the experimental condition, $X^2(2) = 1.18, ns$.

A two-way multivariate analysis of co-variance (MANCOVA) was computed, with sex and experimental condition as the factors, and heart rate at Time 1, 2 and 3, as the dependent variables, and baseline heart rate as the covariate. The MANCOVA revealed a significant main effect of group, when considered with a directional hypothesis, Wilk's $\lambda(6, 104) = 1.87, p < 0.10$. The MANCOVA found a non-significant main effect of sex, Wilk's $\lambda(3, 52) = 1.53, p > .05$. Lastly, the interaction of Sex x Group was also found statistically non-significant, Wilk's $\lambda(6, 104) = .80, p > .05$. Due to the significant main effect of group, mean heart rates for each condition can be found in Table 1.

The MANCOVA on heart rate measures was followed by univariate tests of between-subjects effects. The univariate tests revealed a significant effect of experimental group at heart rate measurement Time 2, Wilk's $\lambda(2, 54) = 3.35, p < .05$. Pairwise comparisons reveal that control group is significantly different from both experimental groups, this occurred in both males and females at Time 2. The univariate tests also found a significant difference between males and females at heart rate measurement Time 3, Wilk's $\lambda(3, 52) = 4.36, p < .05$. Pairwise comparisons reveal that at Time 3, females have a significantly higher heart rate as compared to males; this was found across all experimental groups.

A MANCOVA was computed with blood pressure as the dependent variable, with experimental group and sex as factors and baseline blood pressure as a covariate. The results of

the MANCOVA indicated no significant main effect for experimental group, Wilk's λ (6, 104) = .55, $p > .05$. The MANCOVA did indicate a significant main effect for the sex variable, Wilk's λ (3,52) = 3.60, $p < .05$. Lastly, the interaction of Sex x Group was also found non-significant, Wilk's λ (6,104) = 1.17, $p > .05$. Means for blood pressure measures can be viewed in Table 2.

The MANCOVA on blood pressure measures was followed by univariate tests of between-subjects effects. The univariate tests revealed a significant difference between males and females blood pressure measurements at Time 2, Wilk's λ (1,54) = 7.20, $p < .05$. Pairwise comparisons reveal that at measurement Time 2 females have significantly lower blood pressure measurements as compared to males; this was found across all experimental groups. The univariate tests also found a significant difference between males and females at blood pressure measurement Time 3, Wilk's λ (1,54) = 6.32, $p < .05$. Pairwise comparisons reveal that at Time 3, females also have significantly lower blood pressure measurements as compared to males; this was found across all experimental groups.

In order to examine the hypothesis related to video game experience, a two-way MANCOVA was conducted, with experimental condition and sex as factors, and baseline heart rate and average duration of video game play as covariates. Heart rate was used as the dependent variable. The MANOVA revealed a non-significant main effect for experimental condition Wilk's λ (6,96) = 1.74, $p > .05$. The main effect of sex approached significance with Wilk's λ (3,47) = 2.49, $p < .10$. The test found a non-significant interaction between the Group x Sex variable, Wilk's λ (6,96) = 0.66, $p > .05$.

Although the main analysis did not find a significant effect of sex, an analysis of the univariate test was conducted using a Bonferroni correction to control for familywise error rate; this revealed a significant difference in the sex variable at heart rate measurement Time 3, Wilk's

$\lambda(3,47) = 6.58, p < .016$. At heart rate measurement Time 3 females displayed a significantly higher heart rate as compared to males across all groups. Although only measurement Time 3 provided a significant difference between males and females the mean heart rate scores for females were consistently higher than males. These means can be viewed in Table 3.

Another MANCOVA was run using the covariate of average duration of video game play but with blood pressure measures used as the dependent variable. The MANCOVA revealed a non-significant main effect of experimental condition Wilk's $\lambda(6,94) = 0.819, p > .05$. This MANCOVA also revealed a significant main effect of sex, Wilk's $\lambda(3,47) = 3.62, p < .05$. There was also a non-significant interaction between Group x Sex, Wilk's $\lambda(6,94) = 1.00, p > .05$.

A univariate analysis found a significant difference between males and females at blood pressure measurement at Time 1, with females having lower blood pressure measures across all groups, Wilk's $\lambda(1,49) = 4.28, p < .05$. A similar trend was found at blood pressure measurement at Time 2. Females had significantly lower blood pressure measures as compared to males across all groups, Wilk's $\lambda(1,49) = 8.21, p < .05$. Analyses of blood pressure measurements at Time 3 displayed a non-significant effect of sex. No significance was found, however the values did approach significance levels, Wilk's $\lambda(1,49) = 3.39, p < .10$. These blood pressure means can be found in Table 4.

Discussion

The results of this study show that there was a significant main effect of experimental condition when examining heart rate measurements of participants; there was no main effect of experimental condition when examining blood pressure. There was also a significant main effect of sex, but only when considering the blood pressure measurements of participants. It seems that males had a higher blood pressure than females across all groups. In addition to these main

effects, this study also finds that participants who are less experienced show a higher heart rate measure, as compared to more experienced participants.

Arousal hypothesis

1. Heart rate results

The first hypothesis states that video game play will cause elevated levels of heart rate and blood pressure measures as compared to control groups and baseline measures. This hypothesis was supported when examining heart rate measures. Participants in both video game playing experimental conditions showed elevated heart rate when compared to the control group. The results also show that participants in Need for Speed: Most Wanted had higher heart rate measures than both Need for Speed: Underground 2 groups and the control group. This is consistent with the small body of work on video game arousal which also indicated that players' arousal increases while playing a video game (Griffiths, 2005). An in depth analysis of the experimental condition findings showed that group differences were apparent only after ten minutes of video game play. After ten minutes of exposure to video games, both video game conditions of the experiment differed significantly from the control group. This could be due to features of the video games used in this study; it seems that the video games require a building of momentum in order to cause a change in heart rate. In addition to these results, it seems that females showed elevated heart rate measures after fifteen minutes of video game play, as compared to males. The afore mentioned findings suggest that overall, playing video games is more physiologically arousing than not playing video games, according to measures of heart rate. Also, it seems that length of exposure has an effect on arousal, since differences were found only after ten minutes of exposure to the video game condition. Lastly, it seems that females are significantly more aroused than males after fifteen minutes of video game exposure. The means

of female heart rate measurements are consistently higher (numerically) than those of males; however only after fifteen minutes of exposure do the females have significantly higher heart rate measurements. This finding is interesting especially since the main effect of sex did not reach significance. This may also be related to the length of exposure and the specific features of the games causing a building of momentum. These findings illustrate that hypothesis number one was supported when looking at heart rate measures.

2. Blood Pressure Results

This experiment did not find a significant main effect of experimental condition when considering blood pressure measurements. This aspect of hypothesis one was not supported.

Sex hypothesis

Although sex was not addressed in hypothesis one it is interesting to note that blood pressure measures were not found significant for the group variable, but there was significance in the sex variable. This is parallel to hypothesis number two, which states that males will experience higher levels of arousal in all experimental conditions, since research supports that males are more likely to play video games. This hypothesis was partly supported; males did have higher levels of arousal in all experimental conditions when considering blood pressure. This hypothesis is not borne out when considering heart rate measurements. Prior research in the field of video game addiction states that males are the most excessive users of video games and therefore are expected to have higher levels of physiological arousal (Griffiths 2005). This study, however, finds something different; males do not have higher levels of heart rate and have higher levels of blood pressure in all groups, including control.

Males had significantly higher blood pressure measures as compared to females after ten minutes and again after fifteen minutes of exposure to experimental condition. It appears that

video game exposure may affect males and females differently; causing more of an effect on the heart rate of females, and blood pressure of males. It is also of important to notice that males and females did not differ on blood pressure measures until ten minutes of exposure to experimental conditions. Length of exposure is perhaps a variable that is not considered in this study but is acting on the outcome. Future research may want to consider using length of exposure as an independent variable.

The blood pressure results should be interpreted with caution because the blood pressure of males was higher than females in control groups also; this suggests that there may not be a causal link between video game play and the difference in blood pressure between males and females. Biological differences could be the cause of males having higher blood pressure measures than females.

Violence/Consequence Hypothesis

The third hypothesis considers the actual content of the video game and whether specific games have a differential effect on users. It was hypothesized that persons administered video games with higher violence and lower consequences for violent acts would display increased arousal levels as compared to those administered less violent video games. The results of the experiment showed that there was no significant difference between arousal levels of Need for Speed: Most Wanted and Need for Speed: Underground 2. However, both of these games did increase heart rate levels when compared to the control group. It is possible that no difference was found because of the immense similarities between the games played in the lower violence and high violence conditions. These games each have the same underlying content of drag racing, and are both created by the same publisher. It seems that the two video game conditions were very similar, perhaps too similar to cause a difference in arousal. However, both games

differed from control group when reviewed in the context of heart rate. The difference that was found between control group and the two experimental groups seems to be an interesting mix of duration of play and video game content. The video games did cause a difference in heart rate arousal after ten minutes of play, but is this due to the momentum of the game (duration) or to the content that is presented after ten minutes of play. It is suggested that future research include a more frequent measurements of arousal to determine the exact time that arousal increases. It is also suggested that future research use video games that are similar but not “too similar”.

Another interesting factor that relates to the content of the video games used in this experiment is age. Need for Speed: Underground 2 was rated “E” for everyone, and suggested for persons ages 6 and up; while Need for Speed: Most Wanted was rated “T” for teen, and suggested for persons ages 13 and up. This experiment used a sample of college students between the ages of 18-24; it is possible that video game content that would be highly arousing for a 6 or 13 year old would not have the same effect on a college student. In future research it would be optimal to sample from the population that the video game is marketed to; such as adolescents and teens.

Experience analysis

It was hypothesized that video game experience may have influenced the performance of participants in the study. As noted earlier, 100% of the participant population had some sort of contact with video game media. Although everyone had some prior experience with video game playing only 23% of the sample had extensive experience with video games, while 77% were classified in the novice category. The experienced category was dominated by males with only one female in the entire sample being classified as experienced.

When statistically analyzing the experience variable it seems that there were some differences between males and females. After fifteen minutes of exposure females displayed significantly higher heart rate measurements in both experimental conditions, compared to control. This suggests that perhaps participants who are inexperienced respond to video games with increased heart rate. The act of performing an unfamiliar task, while being observed, may cause increased feelings of performance anxiety thus increasing heart rate measures. This may be the reason for females having elevated heart rate measures when experience variables are considered.

The experience variable was also analyzed in terms of blood pressure measures. These results are similar to the afore-mentioned findings, since females were found to have lower blood pressure measures after five and ten minutes of video game exposure. In this case it seems that participants who were more experienced had higher levels of blood pressure than those less experienced. This may be because video games have a differential effect on males and females especially since the vast majority of females were inexperienced; or this phenomenon may also be attributed to biological differences in men and women.

The findings of this study, in many ways, strengthen the argument that physiological arousal is a key element in video game addiction. It has been shown that video games do have an effect on a user's heart rate measures, causing them to increase. This study also finds that an individual's level of experience with a video game stimulus affects how aroused they may become. Specifically, those less experienced players may have higher levels of arousal. It is possible that these higher levels of arousal in novices may cause an individual to return to video game playing after initial contact with the video game. Thus causing a "non- user" to become a frequent player of video games.

It is important to continue research to determine whether there is a causal link between arousal and video game addiction. In order to do this, research must be conducted on individuals who have been considered video game addicts. In this study the PVP scale has identified only five people out of 61 to be potential “addicts.” For this reason, no further statistical or experimental procedures were completed with the potential “addicts.” The fact that college students, who are traditionally high-functioning individuals, were used for this sample may be the cause of the low scores on the PVP scale. College students tend to be intelligent, responsible, and capable of time management; these traits may have contributed to the low scores on the PVP scale.

Limitations

Possibly the most important limitation is the sample that was used in conducting the video game task. The pool of subjects was limited to college students currently enrolled in a Psychology course at LSU. Participants were traditional aged students between 18 and 24; this may restrict the findings of the study, since college students are typically high-functioning individuals. There may have also been limitations in the motivation of participants; since students signed up for the experiment with the intention of gaining extra credit for their classes, there may have been some participants who did not take the study seriously. There were no noticeable problems with participants treating the study indifferently. In addition, the vast majority of participants were Caucasian, thereby restricting the range of race and ethnicity.

The sample was also biased toward video game novices; only 23% of the sample had any extensive experience with video game play. In ideal circumstances a researcher would have a sample that is comprised of 50% novices, and 50% experienced users. This may provide for more accurate comparisons with regard to the experience variable.

Another set of limitations include the actual nature of the video games used in the study. This task used video games with content based on drag racing; this content may be found preferable to males. Also, this genre of video games is not the most popular and may not accurately portray the extreme level of violence that may be linked to video game addiction. The video games used in this experiment are also very similar; it is favorable to have similar games for experimental control, however if games are too similar they may not cause differences in arousal level. In addition, the findings of the video game task may not generalize to other genres of video games, since the task used only racing games for experimentation.

This experiment uses an XBOX 360 game system; this system is popular among gamers however it may not be representative of all home consoles. During the course of this experiment two other home console game systems were released by Sony and Nintendo. Sony released the Playstation 3, while Nintendo released the very popular Wii. This means that the XBOX 360 is no longer the latest generation of video game console technology; however the XBOX 360 is by no means outdated.

As mentioned above, the PVP scale was used to determine whether an individual could be classified as a video game “addict.” In this study only five male participants were eligible for this category. It is suggested that future research use the PVP scale as a screening measure to ensure that the study has equal numbers of “addicts” and non video game users. This may provide clearer comparisons between groups participating in the experiment. It may also be beneficial for future research to conduct follow-up measurements on participants scoring highly on the PVP scale. The use of follow-up measures may help to determine whether the PVP scale is accurate in its classifying an individual as a video game addict. Follow-up measures may also provide insight into how video game “addicts” can be treated.

The current study only considers person-machine interaction. Many popular video games require multiple players; these opponents may be physically present or the opponent may be connected to the player via the Internet or a phone modem. It may be useful to conduct research on video game playing that requires an opponent; this type of gaming may cause elevated heart rate and blood pressure due to the additional aspect of competition.

Future research can also take into consideration the variables of anxiety and length of exposure. The current study examines only physiological arousal; however a measure of anxiety before and after the video game task may enrich the data set and offer insight into different effects of video games on users. Measures of acute or state anxiety may be beneficial in detecting whether participants are experiencing some form of performance anxiety. It is possible that inexperienced participants may be self-conscious and/or anxious about their performance on the video game task, especially while being observed.

It may also be beneficial to examine the length of exposure to video games, this may help in determining exactly when video games cause elevated arousal levels. This study found that heart rate measures were elevated only after ten minutes of exposure; a more sensitive study can determine the exact point at which arousal is elevated. Future research may also consider administering a measure of subjective mood during and after the video game task; this may help determine whether participants find their arousal level enjoyable or aversive. This may provide more information about the video game itself and/or the user.

The use of video games in American culture and around the world has increased immensely over the past ten years. Video game playing has become more “mainstream” and is now acceptable behavior for individuals of all ages and nationalities. The technology of the video game industry is being updated and upgraded at a rapid pace, while the phenomenon of

video game addiction is becoming more plausible; thus making the field of video game research more lucrative than in previous years. Since there are limitations to this study it is suggested that research in the field of video game addiction be continued. Research sampling a broader population is encouraged especially with more ethnic diversity and also diversity of experience with video games. It will also be beneficial to conduct research using different video game playing media and different genres of video games. It is possible that video games are differentially addictive and this may be the cause of the extreme popularity of specific video games. Researching these concepts could help the overall field of video game addiction and either add to or disprove the findings of this study.

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Table 1 Means and Standard Deviations of Heart Rate Measurements for Males and Females across all Experimental Conditions

<u>Heart Rate</u>	<u>Gender/Sex</u>	<u>Experimental Condition</u>	<u>Mean (deviation)</u>	<u>P</u>
HR@ time 1	Male	Control	68.3 (11.24)	.502
		Underground 2	71.9 (9.02)	
		Most Wanted	74.6 (14.61)	
	Female	Control	74.67 (10.97)	.502
		Underground 2	75.33 (11.48)	
HR@ time 2	Male	Most Wanted	78.6 (11.1)	.043
		Control ^{1 2}	67.1 (9.2)	
		Underground 2 ¹	70.9 (7.45)	
	Female	Most Wanted ²	74.1 (14.1)	.043
		Control ¹²	69.56 (8.9)	
		Underground 2 ¹	76.25 (12.8)	
		Most Wanted ²	77.8 (13.34)	
HR @ time 3	Male	Control	71.3 (11.83)	.580
		Underground 2	68.0 (6.99)	
		Most Wanted	73.2 (11.61)	
	Female	Control	75.11 (6.62)	.580
		Underground 2	76.83 (15.32)	
		Most Wanted	78 (14.11)	

Note: HR = heart rate, superscripts indicate significant differences

Table 2. Means and Standard Deviations of Blood Pressure Measurements for Males and Females across all Experimental Conditions

<u>Blood Pressure</u>	<u>Gender/Sex</u>	<u>Experimental Condition</u>	<u>Mean(deviation)</u>	<u>P</u>
BP@ time 1	Male	Control	1.62 (0.166)	.082
		Underground 2	1.70 (0.163)	
		Most Wanted	1.66 (0.163)	
	Female	Control	1.63 (0.188)	.082
		Underground 2	1.54 (0.089)	
		Most Wanted	1.55 (0.220)	
BP@ time 2	Male ¹	Control	1.61 (0.181)	.010
		Underground 2	1.64 (0.151)	
		Most Wanted	1.70 (0.227)	
	Female ¹	Control	1.56 (0.122)	.010
		Underground 2	1.50 (0.107)	
		Most Wanted	1.56 (0.174)	
BP@ time 3	Male ¹	Control	1.69 (0.194)	.015
		Underground 2	1.68 (0.144)	
		Most Wanted	1.72 (0.175)	
	Female ¹	Control	1.52 (0.161)	.015
		Underground 2	1.60 (0.113)	
		Most Wanted	1.60 (0.294)	

Note: BP= blood pressure, superscripts indicate significant differences.

Table 3. Means and Standard Deviations of Heart Rate Measurements found by MANCOVA using average duration of Video Game play as a covariate

<u>Heart Rate</u>	<u>Gender/Sex</u>	<u>Experimental Condition</u>	<u>Mean (deviation)</u>	<u>P</u>
HR@ time 1	Male	Control	68.3 (11.24)	.114
		Underground 2	71.22 (9.3)	
		Most Wanted	74.6 (14.61)	
	Female	Control	72.5 (9.44)	.114
		Underground 2	76.4 (11.46)	
		Most Wanted	78.6 (11.09)	
HR@ time 2	Male	Control	67.1 (9.19)	.478
		Underground 2	70.6 (7.81)	
		Most Wanted	74.1 (14.11)	
	Female	Control	67.5 (6.87)	.478
		Underground 2	77.6 (12.38)	
		Most Wanted	77.8 (13.34)	
HR@ time 3	Male ¹	Control	71.3 (11.83)	.013
		Underground 2	67.67 (7.33)	
		Most Wanted	73.2 (11.6)	
	Female ¹	Control	73.8 (5.6)	.013
		Underground 2	78.6 (15.47)	
		Most Wanted	78 (14.11)	

Note: HR = heart rate, superscripts indicate significant differences.

Table 4. Means and Standard Deviations of Blood Pressure Measurements found by MANCOVA using average duration of Video Game play as a covariate

<u>Blood Pressure</u>	<u>Gender/Sex</u>	<u>Experimental Condition</u>	<u>Mean(deviation)</u>	<u>P</u>
BP@ time 1	Male	Control	1.62 (0.166)	.044
		Underground 2	1.69(0.172)	
		Most Wanted	1.66 (0.163)	
	Female	Control	1.62 (0.197)	.044
		Underground 2	1.54 (0.089)	
		Most Wanted	1.55 (0.220)	
BP@ time 2	Male ¹	Control	1.61 (0.181)	.006
		Underground 2	1.60 (0.103)	
		Most Wanted	1.70 (0.227)	
	Female ¹	Control	1.55 (0.129)	.006
		Underground 2	1.47 (0.083)	
		Most Wanted	1.56 (0.174)	
BP@ time 3	Male	Control	1.69 (0.193)	.072
		Underground 2	1.66 (0.126)	
		Most Wanted	1.72 (0.175)	
	Female	Control	1.51 (0.171)	.072
		Underground 2	1.58 (0.124)	
		Most Wanted	1.60 (0.294)	

Note: BP=blood pressure, superscripts indicate significant differences.

Appendix A

Video Game Status Questionnaire

Date: _____

ID# _____

- 1) Age: _____ 2) Sex (circle one) MALE FEMALE
- 3) Which ethnic/ racial group do you most identify yourself? (circle one)
- a. Caucasian d. Hispanic
- b. African-American e. Other
- c. Asian

For the purposes of this questionnaire video game playing is considered playing a video game (for amusement) on devices such as: home console, arcade, computer, hand-held/ portable device, cellular phone.

- 4) Do you play video games every day? (circle one) YES NO
- 5) Have you ever played video games on any of the above stated technological devices? (circle one) YES NO
- 6) Did you ever play video games every day? (circle one) YES NO
- If YES: 6a. What is/was the average duration of video game play, per session?

6b. What was the longest (ever) duration of video game play?

- 7) How often do you play video games?(circle one) NEVER DAILY (once or more each day) MONTHLY(once or more each month)
- 8) At what age were you introduced to video games? _____
- 9) I think I play video games too much? (circle one) YES NO
- 10) I think I have some type of problem associated with video game playing? (circle one) YES NO
- 11) Have you ever played Need for Speed Underground 2? YES NO
- 12) Have you ever played Need for Speed Most Wanted? (circle one) YES NO

Appendix B

Problem Video game Playing scale

- 1) When I am not playing with video games I keep thinking about them i.e. remembering games or planning the next game. YES NO
- 2) I spend an increasing amount of time playing video games. YES NO
- 3) I have tried to control, cutback, or stop playing, or I usually play with the game longer than I intended. YES NO
- 4) When I lose in a game or I have not obtained the desired results, I need to play again to achieve my target. YES NO
- 5) When I can't use the video games I get restless or irritable. YES NO
- 6) When I feel bad e.g. nervous, sad, or angry, or when I have problems, I use the video games more often. YES NO
- 7) Sometimes I conceal my video game playing to others, that is, parents, friends, and teachers. YES NO
- 8) In order to play video games I have skipped class or work, or lied, or stolen, or had an argument or fight with someone. YES NO
- 9) Because of video game playing, I have reduced my homework, or schoolwork, or have not eaten, or I have gone to bed late, or I spent less time with friends and family. YES NO